ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LVII, No. 4. CHICAGO, SATURDAY, JULY 23, 1910. ISSUED WEEKLY.

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY
CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood, Manager.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall, Manager.

CHARLES W. PRICE .....Editor-in-Chief
A. A. GRAY .....Managing Editor
MORTON GITHENS LLOYD .....Technical Editor
HENRY FARRINGTON .....Associate Editor
F. H. BERNHARD .....Associate Editor
HOWARD EHRLICH .....Associate Editor
C. H. SEAVER .....Associate Editor

SUBSCRIPTIONS.

One Year, United States	$2.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS 157
American Peat Society 160
Hydroelectric Extension in New Zealand 160
Illuminating Engineering Society Offers Inducement to New Members 160
John W. Lieb, Jr. 161
Automobile Engineers' Convention 161
Government Lamp Contracts Awarded 162
New International Commercial Congress in United States 162
International Rubber Convention 162
Electrical Engineering in the Reclamation Service 162
Victoria Falls Power Company 162
Public Utility Tax in Chicago 162
Trade Opportunities in West Indies 162
Edison Electric Locomotive No. 2 163
The New Edison Storage Battery 165
A Municipal Exhibition 169
Electrical Exports for May 169
Lease Brooklyn Subway Extension 169
Ohio Electric Light Association 169
The Use of Storage Batteries in Direct-Current and Alternating-Current Central Stations 170
Telephone Merger in Indiana 171
Chicago Electric Club Picnic 171
Standard Specifications for Transformers 172
Chemical Effects of Ultraviolet Rays 173
Electric Strength of Argon 173
Alternating-Current Industrial Power-Plant Switchboards 174
Chicago's New City Hall to Use Hydroelectric Power 177
Rainbow Falls Power Development in Operation 177
Utilizing Iceland's Waterpowers 177
English Municipal Electric Plant Shows Deficit 177
Temperatures of Lamp Filaments 178
Cheap Arc Lights in Cumberland 178
Decorative Lighting at Terre Haute, Ind. 178
Lighting at Mexican Centennial 179
German Activity in Exporting Incandescent Lamps 179
Street Lighting in Chicago 180
Ornamental Street Lighting Projects Advance 180
The Government's Telephone Service in London, England 181
Subway Telephone Installations Started in Chicago 181
Wireless in the Far East 181
Navy Wireless Stations 181
Telephone Suit in Nebraska 181
To Enforce Wireless Law 181
The History of the Telephone 182
New Telephone Building for Boston 183
English Wireless Bill 183
American Telephone Experts to Attend International Conference in Europe 184
Important Telephone Merger 184
Telephones in the Antartic 184
Wireless in the Far East 184
Montefiore Prize 184
Telephone Franchise Provides for Underground Wires 184
Electrical Trade Purchases by Argentine 184
June Exports of Copper 184
QUESTIONS AND ANSWERS 188
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 189
AMONG THE CONTRACTORS AND SUPPLY MEN 189
NEW ELECTRICIAL AND MECHANICAL APPARATUS AND APPLIANCES 190
CURRENT ELECTRICAL NEWS 195
RECORD OF ELECTRICAL PATENTS 201

Copyright 1910 by the Electrical Review Publishing Company.

BAD ROADS AND THE ELECTRIC VEHICLE.

Some time ago a certain well-known business man in Chicago bought an electric vehicle for his personal use. He was so pleased with it that shortly afterwards he acquired two more for his family. Not long after this, however, he greatly surprised his friends by appearing around town in a gasoline touring car, and when asked for his reasons for substituting the gasoline for the electric car, after being so enthusiastic about the latter, he explained that the electric had not sufficient mileage capacity on the Chicago roads.

It was not the fault of the car, but of the roads. Many a purchaser of an electric vehicle has found to his chagrin that a car which was supposed to have a mileage capacity of forty, fifty, or sixty miles, when put to the test of actual experience was able to run only twenty-five, or thirty, or thirty-five miles. Ordinarily an electric is only required to run from about ten to twenty miles a day, but it must be somewhat disconcerting to the owner of an electric car when he decides on some particular day to make a journey a few miles, say, within the supposed capacity of the car, only to find that the batteries run out before reaching his destination.

It is astonishing what a difference in mileage capacity there is between running on a bad road and a road which is well built and kept in good repair. Any electric car has a large overload capacity, and this usually enables it to negotiate successfully some very bad roads, but only at the expense of an abnormal drain on the batteries which, of course, materially cuts down the mileage capacity of the vehicle.

One does not expect to find in country places roads with surfaces like billiard tables, but surely it is not too much to expect the authorities of a large and prosperous city like Chicago to keep the roads within the city limits in good repair. And yet it is true that the roads in districts outside of the city limits of Chicago are very much better on the whole than even the main highways through many of the suburbs, as, for instance, Jefferson Park.

If electric-vehicle manufacturers, central stations, and owners and users of electric automobiles will get together and make a concerted and energetic campaign for good roads, much would soon be accomplished toward keeping the main highways of our cities and towns in good repair, and the electric vehicle would increase in popularity at an even greater rate than it is doing at present.

STANDARDIZATION.

In the early days of the electrical industry, changes came so close upon each other's heels that what was regarded as standard to-day might be obsolete to-morrow. With improvements being continually developed in almost every field, designs could not become stereotyped, nor practices very firmly established. Progress has by no means ceased, as is evidenced by the metallic-filament lamp, the core of silicon-steel, the ever-increasing transmission voltage, and similar recent advances in almost every line of activity.

Nevertheless, much electrical engineering practice has become very generally established, much of the manufacturing and designing has been reduced to a definite system, and certain general principles have been recognized as guides which should be universally followed. For instance, the frequencies suitable for power transmission and for lighting have been firmly established, although the frequencies best suited to wireless work are as yet not very definitely determined. As a consequence, we have a certain amount of standardization in the industry, and it is increasing yearly.

The Fire Underwriters have given us a code to govern wiring and installation, and the Standardization Rules of the American Institute are a recognized authority on practice and tests. Other organizations have already laid down rules covering their respective provinces, or have committees now at work formulating them. Of late years the standardization of specifications has received attention and has already made considerable progress. The Society for Testing Materials has committees working on specifications for copper wire and for coal. The motor manufacturers are working to the same end for their product. Several years ago the Bureau of Standards published specifications for incandescent lamps and it has just issued a similar circular on self-cooled transformers.

Such standard specifications fulfill a three-fold purpose. For the engineer unfamiliar with the details of the particular product involved, they furnish a guide which will insure his covering the essential points without including unessentials. To the manufacturer it serves as an indicator of what will be expected of him and the least that will be accepted from him, and helps to make it easier to satisfy customers with a standard line. To the experienced purchaser, having full knowledge of the requirements of the material or apparatus to be bought, it is less necessary, but does assist him by helping to make good product standard.

Any such specifications or standardization rules must be revised, from time to time, to keep pace with the progress of the art; otherwise they become a hindrance rather than a help. They are not to be regarded as fixed and permanent, but as representing a stage in the evolution of the art. When defects are found, they should be called to the attention of the persons in charge. Only by wide co-operation can the best results be secured.

TRANSFORMER SPECIFICATIONS.

On another page will be found the standard specifications for transformers recently issued by the Bureau of Standards, and applicable to the oil-immersed and self-cooled type. These specifications are drawn up primarily for the use of the Government Departments, but may well serve as a basis for individual purchasers also.

The specifications appear to be drawn with sufficient latitude to admit the variations in design which exist between different manufacturers, and yet are rigid enough in performance requirements to insure first-class apparatus. Thus impregnation of the coils is not required where insulation is used which is moisture-proof. It is to be noted that little stress is laid upon aging, in recognition of the fact that this fault, formerly so common, has been eliminated by the use of silicon-steel; yet an aging test is left optional with the purchaser.

The requirements for oil are placed rather high, and it will require care on the part of the manufacturer to meet them. The closed-cup method is required for a flash-point test, which is an improvement upon the method, more common in this country, of using an open cup, since a more definite and reliable test can be made with the closed cup. It is not difficult to secure oils having high flash-points, but high flash-points are usually accompanied by lower dielectric strength and higher viscosity, and often also by a tendency to carbonization and formation of sludge. The determination of an appropriate flash-point must therefore be a compromise, and the value of 170 degrees would not be suited to high-potential work requiring greater dielectric strength.

The manufacturer is not required to have a sine wave of voltage available for testing purposes, providing he has suitable means for correcting for any variation from the sine. This provision permits competition from the smaller manufacturers, who are often limited in testing facilities, and who were practically barred out in the specifications formerly used by the Navy Department. An improvement over the latter is also to be noted in that a heating test is not required upon every transformer.

The basis for comparing guarantees, based upon operating efficiency, will probably not be satisfactory to all the manufacturers, yet this seems to be the only equitable method of taking into consideration the variations in design. The apparatus of lower efficiency is not as valuable to the buyer, other things being equal, and should not be admitted upon equal terms. The table of allowable losses sets a maximum, and different makes of transformers will come under these figures by varying amounts, and should receive in each case appropriate credit. The proper valuation to be put upon core and copper losses must necessarily depend upon the conditions of use and no particular figures can apply generally. It seems very proper, however, to value them differently, since copper loss is largely expended at peak load, when power is worth all

it sells for; while core loss is usually worth only what it costs to generate it.

The table puts a limit upon regulation at both 100 per cent and 60 per cent power factor. While the latter condition is not one often occurring in operation, the regulation for this condition is, to a certain extent, a measure of the leakage reactance of the transformer, which thus has a limit put upon its value.

INDUSTRIAL ELECTRIFICATION.

Many manufacturing plants and quite a number of municipalities are, with the advance of electricity, waking up to the fact that from a standpoint of reliability, electricity is by far superior to steam or hydraulic power. There are numerous reasons for this; for floods, low water and other things known in law as "Acts of God," may serve temporarily to disable the power source at times when power is most necessary.

It cannot, however, be denied that the incentive to make such a change must be very strong, after steam or hydraulic machinery has given fairly good service. For this reason, perhaps, many companies have been waiting until their present machinery wears out or becomes antiquated. But every day, companies "get through waiting" to take this step which will secure for them a more satisfactory and more reliable source of power.

A case in point is that of a well-known manufacturing town in New York State. For more than half a century the mills in the place alluded to have been operated by hydraulic power supplied by a corporation. Each manufacturer is supplied with such amounts of water as he desires—when this is not prevented by low water or other causes. A system of canals carries this water to each manufacturing plant, and each provides its own hydraulic machinery. At times it is impossible with the present equipment for a manufacturer to secure enough power.

That there was at times a shortage of water has been sufficient reason to take definite steps for a more reliable power supply. With the change to electric power which is now agitated, the system would not only be more flexible, but supplemented by a steam-driven electric-generating plant would be absolutely dependable.

Another plant located in Pennsylvania has, after about twenty years' use of steam power, decided to change over and install a complete electric plant for power and lighting. Perhaps in this plant it is a case of worn-out machinery, but nevertheless it indicates that the manufacturers are seeking the best power.

These cases are only two out of many that are reported repeatedly in our daily papers. Everywhere the use of electricity is spreading, and with the many changes from steam and hydraulic power to electricity there are but few reversions to the more primitive methods.

SECURING THE SMALL CONSUMERS.

Many prospective consumers of electricity have been lost by reason of the fact that a great number of householders literally cannot afford the cost of wiring their houses, and others, who could well afford to pay the bill, refuse to do so because they do not care to put their hard-earned money into improvements of a landlord's premises, which they may vacate at the termination of their lease. Ordinary electric wiring represents a capital investment which becomes a total loss to a tenant when he moves from one house to another, and unless the landlord or owner can be induced to bear the whole or a large part of the cost, there are few of these people willing to adopt electricity in the home. Schemes like that of the Commonwealth Edison Company, of Chicago, which company will wire a house at cost on a two-years' installment plan, are calculated to meet the requirements of people of moderate means who own their own homes or who for some reason or another expect to stay in their present residence for some time to come. But even these plans do not appeal to the tenant who is uncertain whether he will renew his lease at the end of the year.

In England there are several concerns which make a specialty of surface wiring, and central stations in that country have been able to secure many new customers by this cheap and effective means. As may be expected, most of the new business obtained in this way has been from the poorer classes, but strange to relate, there are many prosperous concerns, such as some of the great English schools, which have adopted surface wiring in changing over to electricity from some other form of illumination. And it must not be supposed that these exposed wiring systems are all unsightly. On the contrary, some of them are even artistic, and furthermore, such skill has been expended in installation that the wiring in many cases is practically invisible and is quite as safe as the usual conduit wiring systems. Of course, the cost of installing surface wiring is much less than for other systems, and, what is perhaps equally as important, the necessity for tearing down plastering, etc., is almost entirely obviated.

It is time that manufacturers, contractors and central stations began to realize the tremendous help that exposed systems of wiring will afford them in developing new business, especially in hitherto unwired buildings and in securing orders for the rewiring of premises that were wired years ago when wall switches and sockets were not used to the extent they are today.

In later issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN there will appear a series of articles devoted to this subject of surface wiring, which is proposed not as a substitute for conduit or other forms of wiring, but rather as a supplementary means of acquiring customers who could not be otherwise interested in electricity.

AMERICAN PEAT SOCIETY.

PROGRAMME OF THE FOURTH ANNUAL MEETING TO BE HELD AT OTTAWA, CANADA, JULY 25, 26 AND 27.

The official programme of the fourth annual meeting of the American Peat Society, which is to be held at Ottawa, Canada, July 25, 26 and 27, is as follows:

July 25, Morning Session, 9:00 a. m.—Opening remarks by President Eugene Haanel. Report of Officers. Committee Reports. Propositions for the Welfare of the Society. Nomination of Officers. History of Peat Industry of Canada (Alexander Dobson, Beaverton, Ont.). The Government Peat Plant at Alfred (A. Ansep, Jr., of Department of Mines).

Afternoon Session.—Excursion to Government Peat Plant at Alfred.

Night Session, 7:30 p. m.—Address by the President (Dr. Eugene Haanel). Draining of North Carolina Swamp Lands, and Amount of Peat Found Therein (Dr. Joseph Hyde Pratt, State Geologist, N. C.). Peat Power Generation (Dr. T. Arthur Mighill, Boston). Work of the Peat Engineering Company (Francis J. Bulask, Toledo). A New Portable Peat Machine (Ernest V. Moore, Peterborough, Ont.). Description of Col. John Jacob Astor's Vibratory Peat Disintegrator for Peat Gas Producers.

July 26, Morning Session, 9:00 a. m.—Election of Officers. The Journal of the American Peat Society. Peat Investigation of the United States Geological Survey. The United States Bureau of Mines (Prof. Charles A. Davis, Peat Expert, United States Bureau of Mines). Drying Peat (Dr. J. McWilliam, London, Ont.). A Well-Equipped Peat-Fuel Plant, and How to Operate It (Philip Heseltine, Detroit).

Afternoon Session.—Visit to Government Fuel-Testing Plant in Ottawa, and Automobile Tour About the City.

Evening Session.—Banquet at Hotel Victoria, Aylmer.

July 27, Morning Session, 9:00 a. m.—Prospect of the Peat Industry in the Northwest (Max Toltz, St. Paul). Development of Gas Producers for Peat and Lignite (Prof. R. H. Fernald, Producer Gas Expert United States Bureau of Mines). Progress of Peat Briquetting (O. E. Moulton, Dover, N. H.). The Future of the American Peat Industry (William Eichhoff, Erie, Pa.).

Afternoon Session, 2:00 p. m.—Some Problems of the Peat Filler Manufacturer (J. N. Hoff, New York). Peat as a Fertilizer and Methods of Drying Same (Robert Ranson, St. Augustine, Fla.). The Latest Achievements of the Akerlund Gas Producer (Gibbs Gas Engine Company, Atlanta, Ga.). Peat Litter (J. Bordello, New York).

The Russell House, a European-plan hotel, has been selected for the headquarters of the meeting. Arthur J. Forward, Ottawa, Canada, is the chairman of the reception committee, and will be pleased to answer all inquiries.

Hydroelectric Extension in New Zealand.

The city of Dunedin, New Zealand, now has available an extra 2,000 horsepower of electrical power, from the recently completed extensions of the Waipori hydroelectric station.

The Work of the New Bureau of Mines.

The act establishing a Bureau of Mines in the Department of the Interior, approved May 16, 1910, became effective July 1. As originally approved, the law contemplated the transfer of the entire Technologic Branch of the United States Geological Survey, the mine accident investigations, fuel investigations, structural materials investigations, the entire personnel, property and equipment, to the Bureau of Mines but the Sundry Civil appropriation act approved June 25, amended the law to such an extent that the structural materials investigations, including the personnel and equipment for these investigations went to the Bureau of Standards.

Carrying out the spirit and intent of the law so amended, the Secretary of the Interior has transferred to the Bureau of Mines the investigation of mine accidents and fuels, together with the personnel and equipment of these investigations and has transferred to the Bureau of Standards the structural materials investigations and the employes of the Technologic Branch of the Survey engaged in these investigations. The fully equipped testing station at Pittsburg also goes to the Bureau of Mines.

The work of the Bureau of Mines for the first year will be a continuation and expansion of the work carried on by the Technologic Branch of the Geological Survey, and the investigations of mine accidents will be the feature of the work. Three hundred and ten thousand dollars was appropriated for mine accident investigations. Of this sum, $120,000 is to be spent on the rescue stations. The allotment for the investigation of explosives is $40,000; for electricity in mining, $14,000; appliances for preventing mine accidents, $8,000; examination and codification of mining laws, $5,000; and other technologic investigations, ore treatment, etc., $10,000. For the analyzing and testing of the coals, lignites, ores, and other mineral fuel substances belonging to or for the use of the United States, $100,000 was appropriated.

The fuel investigations under the Geological Survey and which are transferred to the Bureau of Mines have already resulted in a better realization throughout the country as to the value of fuels. One result of this work is that nearly all of the fuel now purchased by the federal government is bought on specifications and subject to test by the fuel division, or purchased after examination made of the coal supplied by the mines from which coal is delivered to the government.

The publications of the Survey relating to mine and fuel investigations, will in the future be distributed by the Bureau of Mines. The publications relating to structural materials will continue to be distributed by the Survey.

The first of the Bureau of Mines bulletins, the Volatile Matter of Coal, will be published in the next few months. There will follow, Coal Analyses, Final Data Regarding Steam Tests, North Dakota Lignite as a Boiler Fuel, Producer-Gas Tests in 1905-1907, The Coke Industry as Related to the Foundry, Coals for Illuminating Gas, and Petroleum for Combustion under Steam Boilers.

These publications when issued can be obtained by addressing the Director of the Bureau of Mines, Washington.

Illuminating Engineering Society Offers Inducements to New Members.

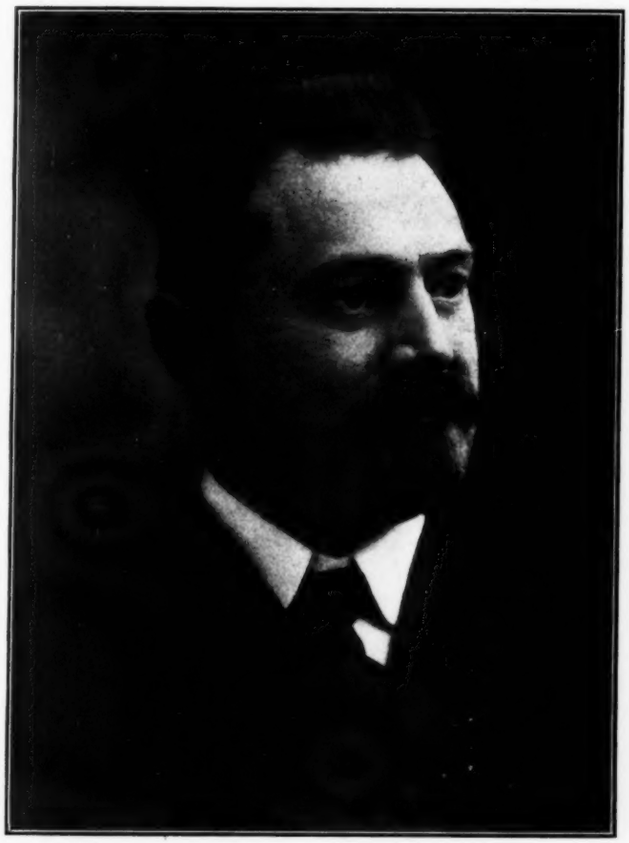
The Membership Committee of the Illuminating Engineering Society has been very active recently and has received over 170 applications for membership. These applications are largely from men whose business or profession depends upon the lighting industry and who appreciate the great strides which have been made and are being made by the Society for the betterment of illuminating conditions. It is the plan of the Membership Committee to extend an invitation of membership to every one interested in the objects of the Society, which are the advancement of the theory and practice of illuminating engineering. The Membership Committee would call the attention of every one to the Transactions of the Society as the best reference that any Society can give.

Now seems to be the accepted time for those desiring membership, inasmuch as the Executive Council has waived the initiation fee for a period of a few months. Any person desiring to join this Society can communicate directly with its secretary or with J. Robert Crouse, chairman Membership Committee, 1918 East 45th Street, Cleveland, O.

John W. Lieb, Jr.

John William Lieb, Jr., was born in Newark, N. J., on February 12, 1860. His early education was obtained at the Newark Academy and the Stevens High School at Hoboken, and he graduated from Stevens Institute of Technology in 1880, with the degree of mechanical engineer.

Shortly after he became a draftsman with the Brush Electric Company in Cleveland, and the following year entered the employ of the Edison Electric Light Company of New York in a similar capacity, later on being transferred to the experimental department of the Edison Machine Works in 1882. While in this department he assisted with the tests of the first "Jumbo" direct-connected Edison dynamos, which resulted in Mr. Edison placing him in charge of the installation of the electrical equipment of the Pearl Street station under the direction of C. L. Clark, chief engineer. He assisted in all the tests and experiments incident to the installation and starting of this pioneer station which was the first commercial station in the United States supplying current for electric lighting and power from an underground system, and on the inauguration of the regular service on September 4, 1882, under the direct auspices of the Edison Electrical Illuminating Company of New York, he was appointed the First Electrician.



JOHN W. LIEB, JR.,
Vice-president of the New York Edison Company.

About this time a syndicate of Italian capitalists with Professor Columbo as technical advisor, purchased a complete equipment of boilers, engine dynamos, and Edison underground system for the city of Milan. Mr. Lieb was selected to direct the installation. Regular service was begun in 1883, and Mr. Lieb remained in charge of the organization of the Italian Edison Company, being in turn appointed chief electrical director, and chief engineer of the technical departments of the company which engaged in the manufacture of electrical apparatus, installation of isolated plants, and construction of lighting and power stations throughout Italy. The Italian company was the first to exploit the alternating-current system of distribution in Milan, and also using the Thomson-Houston arc lighting system. He was also the prime mover in the electric railway field, installing the first overhead electric-trolley system in Milan.

Mr. Lieb returned to his old company, the Edison Illuminating Company of New York, in 1894, at first in the capacity of assistant to the first vice-president, advancing step by step to third vice-president and general manager. On the consolidation of the various companies in New York city, under the corporate name of the New York Edison Company, he was appointed third vice-president and assistant general manager.

He is president and a director of the Electrical Testing Laboratories of New York; vice-president and a director of the Edison Light and Power Installation Company; and a director of the Empire State Subway Company, and the Yonkers Electric Light and Power Company. He is a past-president of the American Institute of Electrical Engineers, of the New York Electrical Society, and a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Associazione Electrotecnica Italiana, and of the National Electric Light Association and Franklin Institute. He is a member of the Engineers' Club, of the New York Municipal Art Society, and the American Museum of Natural History. On several occasions he has been honored by the graduates of the Stevens Institute, and has been president of the Alumni Association and Alumni trustee. On account of his connection with the development of lighting and power in Italy he has been decorated by the King of Italy with the order of Knight Commander of the Order of the Crown of Italy.

Mr. Lieb is an enterprising and influential man of affairs. He is possessed of a most charming personality, is a ready conversationalist, and a lecturer of great ability.

Automobile Engineers' Convention.

The Society of Automobile Engineers will hold its meeting in Detroit, Mich., on July 28, 29 and 30, next.

The following items, culled from a lengthy programme, should be of interest:

Mixed (gasoline-electric) systems.

How can the spark and throttle of commercial vehicles be made foolproof?

The Edison battery from actual tests; life from practical experience.

Low-voltage motors for electric vehicle propulsion.

Recent improvements in electric storage batteries for both power and lighting.

Ampere-hour meters for electrics.

Relation of tire, battery and general repair maintenance cost.

Fixed ignition timing.

Dual versus double-ignition systems.

High-tension versus low-tension magnetos.

Magneto efficiency.

Government Lamp Contracts Awarded.

It has been announced by the Treasury Department, which has charge of the purchase of electric lamps for all government departments except the Navy, that the joint award recently made contemplates the expenditure of about $170,000. This amount is almost $30,000 less than the amount required before the specifications were standardized and the orders were consolidated. The award was made to the General Electric Company, Columbia Incandescent Lamp Company and the Novelty Incandescent Lamp Company.

During the year one lamp will be taken from each barrel purchased and tested at the Bureau of Standards in order to protect the government in quality of lamps delivered from the factories to the public buildings throughout the country. In addition, it has been decided to invite bids on next year's supply six months in advance. Inspectors will then visit factories to select samples at random, to determine the capacity as to the output and the ability of the companies to maintain the government's standard. Thus a credit as to quality will be established before the department enters into contract.

The sixteen-candlepower lamps, 110 volts, which are used as the base, will cost this year: Carbon filament, 12.92 cents; metalized filament, 14.86 cents; tantalum filament, 29.70 cents; tungsten filament, 40.68 cents. Professor Rosa, who has conducted the experiments for the department, reports that the average life of the lamps is: Carbon, 400 hours; metalized, 600 hours; tungsten and tantalum, each 800 hours, and that while the length of the life of a tungsten lamp is double that of a carbon filament, the current consumed is less than half, the efficiency for carbon filament being 3.3 watts, as against 1.3 for tungsten. For this reason carbon lamps are being superseded by tungsten and tantalum lamps wherever possible, only forty per cent of carbons having been supplied during the year just closed.

Next International Commercial Congress in United States.

The fourth International Congress of Chambers of Commerce and Industrial Associations, which met at London, June 21, 22, and 23, was attended by 450 delegates, representing the principal nations, there being six delegates from commercial bodies in the United States, as well as a government representative—Commercial Agent Patrick J. Lennox. Frank D. La Lanne, president of the National Board of Trade, Philadelphia, formally invited the congress to meet in the United States in 1912, the invitation being accepted with enthusiasm.

International Rubber Convention.

The India Rubber World states that the next International Rubber and Allied Trades Exhibition will be held on June 28, 1911, in the Royal Agricultural Hall, Islington, London, England. The president is to be Sir Henry A. Blake and the chairman of the advisory committee Colonel William J. Bosworth. A. Staines Manders is organizing manager.

Most of the leading British rubber manufacturers have consented to serve on the exhibition committee, and a number have reserved exhibition spaces. The Central Union of German Rubber Manufacturers has officially approved of the exhibition and recommended to the authorities that the German colonies be well represented.

The plan of the exhibition, as last year, embraces plantation rubbers of every description and illustrations of processes of production; likewise wild rubber and processes employed in connection with them. Included under these heads are gutta-percha, balata, and the like. These exhibits will embrace botanical specimens and all the various utensils and machines required for the preparation of rubber, together with all of the requisites for rubber estates, wild or cultivated.

The manufacturers' section will be open for machinery, molds, utensils, and so on, employed in making rubber goods of whatever class. Room will be provided also for chemicals and fillers used in the rubber manufacture, including rubber substitutes and reclaimed rubber. Fabrics and all other materials other than rubber used in connection with this industry also will be included.

A separate class will be opened for the literature of the rubber and allied trades. The exhibition offices, from which detailed information may be had, are at 75 Chancery Lane, London, W. C., England.

Electrical Engineering in the Reclamation Service.

In the electrical and mechanical engineering section of the Reclamation Service, with offices in Los Angeles, Cal., working drawings were recently prepared for commercial light and power buildings on the Minidoka project. A preliminary layout has been designed for the pumping station for the Polson unit on the Flathead project. The office has acted in a consulting capacity in the preparation of specifications and preliminary plans for the development of power by the Wonder Electric and Power Company at the power site leased by it on the Truckee-Carson project.

Victoria Falls Power Company.

The report of the Victoria Falls Power Company for 1909 emphasizes the fact that the estimates of cost of production prepared by the consulting engineers are being fully borne out in practice, although the actual figures are not given. A new power house is in course of erection at Rosherville, and when the extensions to Simmer Pan and Brakpan are completed, it is calculated there will, in all the company's stations, be plant capable of turning out 500,000,000 kilowatt-hours per annum. G.

Public Utility Tax in Chicago.

The figures given by the Chicago Board of Assessors on the personal property of the public utilities include an increase of $5,515,055 for the Commonwealth Edison Company, and Chicago Telephone Company, and a decrease of $213,136 for the People's Gas Company. This makes a total increase of $5,301,136, as follows, this year's figures being compared with the final figures of the Board of Review:

	Assessors 1910	Reviewers 1909
Commonwealth Edison	$23,945,000	$21,580,000
Peoples Gas	15,620,509	15,833,645
Chicago Telephone	13,333,155	10,183,100

Trade Opportunities in West Indies.

An American consul in the West Indies reports that a company has been formed for the purpose of supplying the city in which he is located with electricity for lighting and other uses. Further particulars of the report, together with the name of the company, can be otbained by addressing the Bureau of Manufacturers, Washington, D. C., quoting File No. 5160.

EDISON ELECTRIC LOCOMOTIVE NO. 2.

BY FREDERICK A. SCHEFFLER.

The writer was engaged by M. F. Moore, who was the first general manager of the Edison Company for Isolated Lighting, in May 1881, as a draftsman to undertake the work of designing and building Edison's electric locomotive No. 2.

The office of the parent Edison Company was at No. 656 Fifth Avenue, New York city, where all the designing was done at that time.

The first locomotive built by Mr. Edison was merely a working model to demonstrate his ideas along these lines. It had no cab, no "pilot," nor any of the usual features embodying steam-locomotive practice. It was rather a crude affair but nevertheless it was capable of running and doing work on the narrow-gauge track Mr. Edison had laid down at Menlo Park for testing purposes. This locomotive was built before the author became a member of the Edison Crew, and strange to say, although it was his work to design the locomotive No. 2, he never saw anything of No. 1 other than a picture of it, until after No. 2 was in operation.

It was Mr. Edison's idea, as was understood at that time, to build a locomotive along the general lines of steam locomotives, in outward appearance at least, and to combine in that respect the framework, truck, and other parts known to be satisfactory in steam locomotives at the same time.

This naturally required the services of draftsmen accustomed to steam-locomotive practice and the author's previous experience having been in this line of work will explain why he was employed by M. F. Moore, who was a man of great railroad and locomotive experience, and Mr. Moore's knowledge in that direction was of great assistance in the designing and building of this locomotive.

It is needless to say that the author had absolutely no knowledge of anything connected with electricity at that time—not even the schoolboy's sal-ammoniac battery and door-bell experience. One could count so-called electrical engineers on their fingers then and have some fingers left over.

Consequently the electrical equipment was designed by Mr. Edison and his assistants. The data and parts, such as motor, rheostat, switches, etc., were given to the writer and his work was to design the supporting frame,

VIEWS OF EDISON ELECTRIC LOCOMOTIVE NO. 2.

axles, countershafts, driving mechanism, speed control, wheels and boxes, cab, running board, pilot, or "cowcatcher," buffers, and even the supports for the headlight, etc. From the above one can see that the locomotive had all the essential paraphernalia to make it look like a steam locomotive.

The principal part of the outfit was the electric motor. At that time motors were curiosities. There were no electric motors, even for stationary purposes, except freaks built for experimental work. This motor was made from the parts, such as fields, armature, commutator, shaft and bearings, etc., of a "Z" or sixty-light (sixteen candlepower dynamo. In fact that was the only size of dynamo, or generator, that the parent Edison Company had placed on the market.

The power required to drive the "Z" dynamo was ten horsepower (six lamps, sixteen candle power, per horsepower, was the inefficiency of the incandescent lamps in 1881). As a motor it was wound to run at maximum speed to develop a torque equal to about fifteen horsepower with 220 volts.

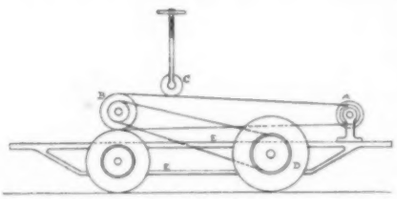
At the generating station at Menlo Park four Z-dynamos at 110 volts were used, connected two dynamos in series in multiple-arc. This gave a line voltage of 220. The motor was located in the front part of the locomotive, and was secured on its side with the armature shaft across the frames, or parallel with the driving axles.

On account of the high speed of the armature shaft it was not possible to connect with driving axles direct, but this was an advantage in one way, as by introducing an intermediate countershaft (corresponding to the well-known type of double reduction motor used on trolley cars since 1881) a fairly good arrangement was obtained to regulate the speed of the locomotive exclusive of resistance in the electric circuit.

Endless leather belting was used to transmit the power from the motor to the countershaft, and from the latter to the driving wheels, which were the front pair of wheels. A vertical idler pulley was mounted in a frame over the belt from motor to countershaft, terminating in a vertical screw and handwheel for tightening the belt to increase speed or the reverse to lower speed. This handwheel was located in the cab where it was easily accessible.

The belt from countershaft to driving shaft was fixed and made "endless" as tight as possible, in the usual manner.

The rough outline sketch given herewith shows the location of motor in relation to countershaft, belting, driving wheels, idler, etc. *A* is the motor,

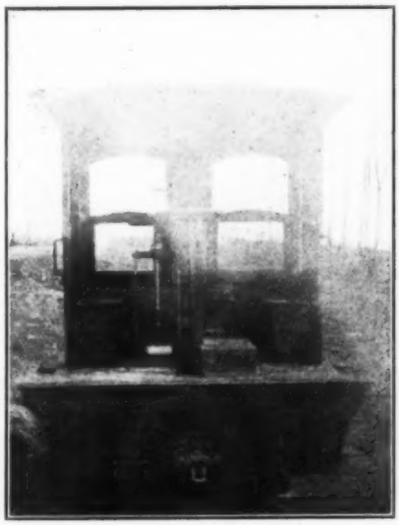


SKETCH SHOWING RELATIVE LOCATION OF MOTOR IN EDISON LOCOMOTIVE NO. 2.

B the countershaft, *C* the idler, *D* the driving wheels, and *E* the frame.

The supporting frames were made by the Rhode Island Locomotive Works, of forged steel in the usual manner. The author is of opinion that the same firm also did the machine work, shipping to the old Goerck Street shops of the Edison Company where the parts were assembled and the locomotive completed.

On account of both rails being used



VIEW OF CAB.

for circuits, one being positive and the other negative, and the necessity of avoiding possible short-circuits being therefore obvious, one of the driving wheels had to be split circumferentially and completely insulated from the axles. This was accomplished by means of heavy wood blocks, well shellaced or otherwise treated, to make them water and weather proof, placed radially on the inside of the wheels, and then substantially bolted to the hubs and rims of the latter.

The weight of the locomotive was distributed over the driving wheels, according to the usual locomotive practice, by means of springs and equalizers. The current was taken from the rims of the driving wheels by a three-pronged collector of brass, against which flexible copper brushes were pressed, a simple manner of overcoming the inequalities of the roadbed, etc.

Reproduction of several photos taken at Menlo Park will give an excellent idea of the general appearance of the locomotive when completed and in running order. The passenger car coupled to the locomotive, as shown in one of the photos, was made by the John Stevenson Company, at its old works in New York city. It was modeled after the well known one-horse horse-car. Samuel Insull, at that time Mr. Edison's private secretary, and now president of the Commonwealth Edison Company, Chicago, Ill., can be seen in two of the pictures, together with the late Charles T. Hughes, who was the New York representative of the Edison General Electric Company for a great many years.

Mr. Hughes, at the time the locomotive was built, was in charge of the track construction at Menlo Park. The gauge was about three feet six inches, and the track was about two and one half miles long. It consisted of grades, curves, viaducts, etc., and in general had all of the characteristics of a regular steam railway.

On account of the rails being used for outgoing and return of the current, they had to be carefully insulated from the ties and ground to prevent short-circuits or leakage of current. The ties also had to be insulated throughout from the ground, and made weather and water proof.

According to the author's best recollections, the locomotive, with the horse car as trailer, made a speed as high as forty miles per hour, and the engine driving the four "Z" generators at the power house, indicated as high as seventy horsepower.

The writer is indebted to F. D. Potter for the photos herewith reproduced. Mr. Potter was an able assistant in making detailed drawings of the parts of this locomotive and the record would be incomplete without a reference to his co-operation.

THE NEW EDISON STORAGE BATTERY.

AN INTERVIEW WITH EDISON—A DESCRIPTION OF THE NEW NICKEL-IRON CELL —THE STORAGE-BATTERY CAR.

The fine record of performance which has been made by the Edison storage battery in its improved form has focused the attention of every one interested in the propulsion of vehicles on this latest product of the great inventor's ingenuity.

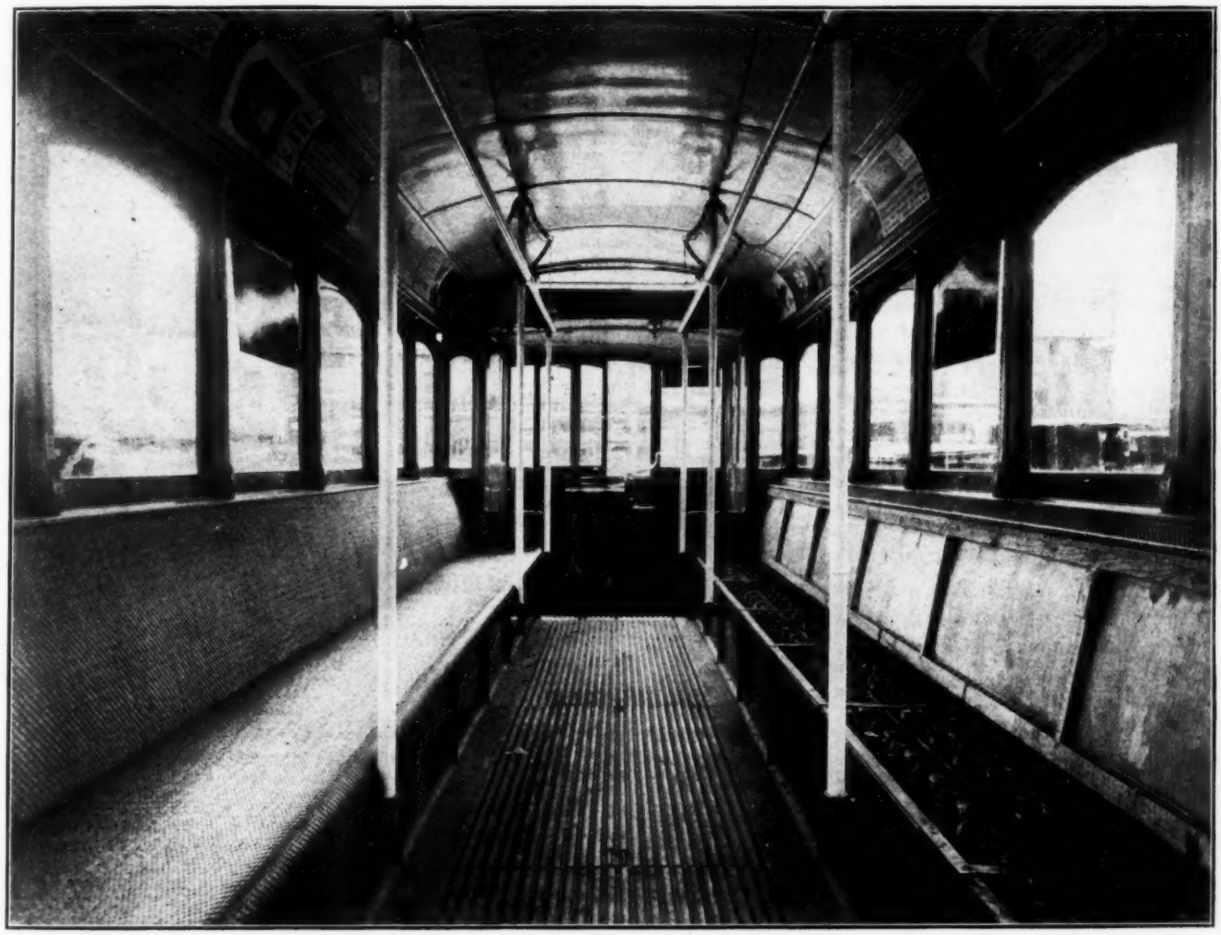


FIG. 1.—INTERIOR OF STORAGE-BATTERY CAR, SHOWING LOCATION OF BATTERIES.

A representative of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN visited Mr. Edison at his laboratory at Orange, N. J., last week and found him in great spirits over the remarkable performance of the battery and the very evident popularity with which the new cell was being received. When the question was asked, whether he was now satisfied that he had the battery in absolute commercial condition, he replied, "I had a good commercial battery—a better battery than had ever been produced before—several years ago, and I was counseled many times to be satisfied with what had been produced; but it did not satisfy me. There are batteries pulling electric vehicles at good efficiency today that were installed four years ago, but, at their best, they in no wise compare with the battery of today. I have two tons of notebooks and curves, and have made over 40,000 tests on this battery, and now I know that I have succeeded in securing an efficient, reliable and very durable cell. One of the greatest troubles I now experience is in securing the proper kind of iron, and even when I get the best that is obtainable, it must be prepared in a very special way or there is a marked difference in the battery performance. The same is true of the nickel, and this must be prepared in a special way; for it is in the preparation of the nickel and iron that there is the greatest opportunity for variations in the battery performance. Catalytic action from traces of impurities has given me a great deal of trouble, and I have been beset sometimes to discover means for getting rid of some of the catalyzers. I am using lithia carbonate in large quantities in the preparation of lithium hydrate, and in this connection I might say that I have had the only piece of luck I have ever known. When I began using lithia it was very, very expensive, but shortly afterwards large quantities were discovered in the Black Hills, and two big companies began manufacturing it; and, in the competition, the price has been brought down to a mere fraction of what it was only a short time ago."

The question was asked, "Will the reduction in the price of the raw material and refinement of design bring down the price of the battery to the consumer?"

"No," he said, "we can't make the battery much cheaper."

"How about the durability?"

"It simply cannot be knocked apart. We have developed a machine which has taken these cells and lifted them and dropped them over one-half inch upon a hard, rigid body 1,000,000 times, without doing any physical damage whatsoever. The containing pockets and pencils are devised and arranged so that they are practically indestructible, and the solution used brings about the desired electrochemical change without attacking either the elements of mechanical construction or deteriorating in any way the active material of which the cell is composed. And the astonishing feature of the battery is its recuperative qualities and its ability to stand heavy discharging, over-charging and absolute short-circuiting. You can overcharge this battery without hurting it a bit; you can discharge it again and again down to a fraction of a volt, and it will come right back. And, more remarkable than this, is the actual growth in capacity of the cell under repeated charging and discharging. I will show you some curves which will clearly indicate that the battery is remarkable in this direction."

"Are you going to develop a battery for other uses?"

"Yes, I am at work now on several new lines, but the thing I am most interested in at present is the development of a battery for railway purposes, from which we can take a very heavy charge or a long-continued discharge, and put the energy back in a very short time; in fact, I shall soon have a battery that we can put into a locomotive and draw three regular railroad cars for twenty-seven miles at the regular schedule speed, and at the end of the discharge put all of the energy back in thirty minutes."

"Will there be any radical difference in the construction of the railway battery?"

"No, there will be no difference in the material or in the construction, except that where the retaining pencils in the present battery are a little over a quarter of an inch in diameter, they will be much smaller in diameter. By greatly increasing the divisibility of the self-contained elements, the internal resistance will be lowered. By increasing the divisibility of the elements we will bring about a ready facility for accelerating both the charging and discharging of the battery."

"What do you think of the prospects of a great development in the utilization of the battery for electric vehicle purposes?"

"It seems to me to be the biggest thing that was ever attempted. You know, this is entirely different from inventing or designing a machine. There you have something tangible, and you can put it together, and if a part fails you can take it away and renew it with something else; but here you have an innumerable series of combinations, all of which must be tried out together, and it is hard indeed to determine just why the various changes come about. I would almost have been persuaded to give it up, were it not such a great big thing. The idea, however, that I might develop a car for the great American people to use—a good car with cheap power, that would be within the reach of everybody—has kept me at it. The idea that we would rid the streets of horses and replace them with electric runabouts and electromotor trucks is what I have been working for, and now I know that this is coming about. They say that the electric vehicle is not a hill-climber, but we have had cars running night and day over the worst kinds of road, through the sand and mud, up hill and down hill, getting a hundred miles on each charge, and still leaving the car with twenty-five or thirty miles in the battery for any emergency. The battery will give an excellent performance on an average of fifteen miles an hour, and if you wish, you can speed it up to twenty-eight miles, if you care to go that fast. The battery is all right, and it is just a question of hitching it up with the right kind of a motor and putting it into the right kind of a car. And this brings me to a very important matter to which I am going to devote my attention. One of the most annoying features of automobiles is in the great difference in the matter of car efficiency with respect to various kinds of tires. I have great faith in the solid tire for electric vehicles, but we must improve the suspension. And the next thing I am going to do is to get the right kind of a tire and the right kind of a suspension, if I have to think it out and make it all by myself!"

Mr. Edison's eyes sparkled and his enthusiasm was contagious. So impressed were those listening to his comments that involuntarily they burst into applause at this display of optimism and enthusiasm.

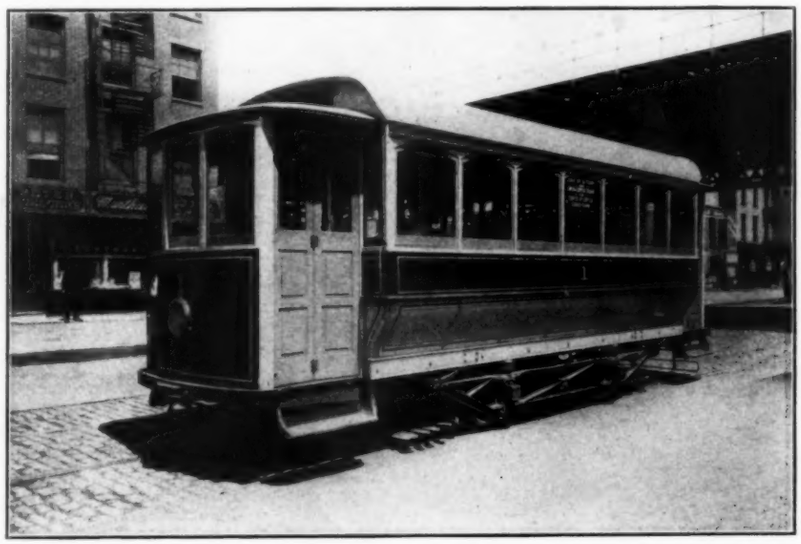


FIG. 2.—STORAGE-BATTERY CAR.

Mr. Edison manifested great interest in indicating the various processes employed in the preparation of the material and the mechanical parts of the cell. Later on a party of visitors was taken to the top of Eagle Rock Hill, one of the most difficult climbing stunts for the automobile, an old car taking the party up to the top without any difficulty, although the car was built on a truck chassis which was much heavier than modern pleasure vehicles. In starting, the voltage reading stood at eighty, and by the time the crest of the hill was reached, over 175 amperes

were being drawn, at a little more than sixty-two volts. Immediately upon reaching level ground the cells recovered and the voltage went up to eighty, two volts higher than the original open-circuit voltage. The voltage maintained itself at about seventy to seventy-two under load during the remainder of the trip.

As is well known, the Edison storage battery depends upon the oxidation and reduction of nickel and iron in a caustic potash solution. The containing cases for both kinds of active material, the supporting grids, the cell poles and their connection parts, and the retaining can and its cover, are all made of nickel-plated steel. This makes possible the use of a material in which lightness, durability and mechanical strength are combined, and admits of a greater output per unit weight of battery; and, in addition, there is eliminated any suspicion as to corrosion or deterioration of either the containing parts or the active material in the alkaline electrolyte.

FIG. 3.—THOMAS A. EDISON AT THE CONTROLLER OF CAR NO. 1 ON THE TRACKS OF THE PUBLIC SERVICE CORPORATION, NEW JERSEY.

The electrolyte is a constant factor, and although decomposed by the charging of the battery, is immediately re-formed in equal quantity on the following discharge and does not change in density or in conductivity.

The negative, or iron, plate has a flat pocket-like construction. These pockets are shaped up from nickel-plated, perforated steel bands, the finished pocket being about one-half inch wide by three inches long, with a maximum thickness of a little more than one-eighth of an inch. Each grid contains twenty-four pockets, spaced eight in a row, in three rows. The positive, or nickel, plate consists of two rows of cylindrical rods or pencils, thirty in number, held in a vertical position by the steel support frame. The cylinders are made from a nickel-plated steel perforated band, with a double-lap spiral seam, which restrains the cylinder from any tendency to expansion; and to further prevent distortion or expansion, each cylinder is fitted with eight steel ferrules.

The preparation of the active material is carried on with great care, and is under the constant supervision of a careful system of checking. In order that there might be ample conducting surface between the nickel hydrate, which is the active material of the positive member, it was necessary to mix the hydrate with a metallic conductor. Experimentation indicated that metallic nickel was possessed of properties which made it an ideal conductor, but the difficulty lay in getting the nickel in thin enough flakes. This resulted in the development of a scheme of electrodeposition of nickel which is not only beautiful in conception, but thoroughly artistic in realization. A machine was developed which consists of a series of cylindrical mandrels supported upon vertical axles, each cylinder dipping into an electroplating tank. The cylinders, constantly rotating, are plunged into a copper bath, and receive a faint blush of copper. They are then withdrawn and carried across on a supporting structure, where they are thoroughly washed, and then carried further on to a nickel-plating bath, wherein they receive a faint blush of nickel. Afterwards they are carried back to the washing bath to be washed, and descend again into the copper-plating solution. In this way a series of 100 platings of copper are interleaved between 100 platings of nickel. The film is then stripped from off the mandrel, and this film is cut into longitudinal sections a little less than a sixteenth of an inch in width. The film, containing 200 separate layers, is about as thick as an ordinary visiting card.

After this film has been cut into longitudinal strips, these strips are cut into squares of about one-sixteenth of an inch in cross-section. The tiny squares are gathered together and placed in a reducing solution. When the metallic copper is removed the nickel flakes separate and are set in drying pans, the moisture is driven off, and metallic nickel is secured in tiny flakes as soft as the finest and sheerest silk.

In filling the positive pencils, a series of pencils are stood upright in a holder, into which a series of rams are plunged. From a hopper on either side of the machine a tiny charge of hydrate is fed into each of the pencils and rammed tight, followed by a tiny charge or layer of metallic nickel. This metallic nickel absolutely insures electrical contact between the sides of the perforated metal cylinder and the nickel hydrate, guaranteeing that every portion of the element is in intimate contact with the electrolyte.

The flat pocket-like containers for the negative material (the iron oxide) are placed in steel forms with shaped mandrels inserted, and are locked securely in place; the forms are placed in the filling machine, the mandrels withdrawn, and the oxide fed in from a hopper in tiny charges, each charge being driven home by a power rammer. Both the negative and the positive elements are assembled in the supporting grids by hand, making a light-weight, but thoroughly substantial, structure.

The plates are then assembled in the nickel-plated steel containing cans, the proper insulating spacers being put in place.

The electrolyte is a twenty-one per cent solution of potassium hydrate, with a small addition of lithium hydrate. The outer surfaces of the outside plates are insulated from the retaining can by hard-rubber sheets. Specially designed hard-rubber pieces are fixed between the can and the side and bottom edges of the plates, and these, together with hard-rubber rods inserted between the plates, maintain correct spacing of the plates at all points and insure permanent insulation.

The side and bottom seams of the can are welded in an oxy-acetylene flame by the autogenous process, and the cover is welded in place by the same process. There are four mountings on the cover. Two of these are the stuffing boxes through which the positive and negative poles extend. One of the other two is the separator, so called because it separates spray from the escaping gas while the battery is charging. This prevents loss of electrolyte and renders the gases inodorous. The fourth mounting is an opening for filling the cell with electrolyte and for adding distilled water to take the place of that which evaporates. This opening has a water-tight cap which is held in place by a strong catch. Fastened to this cap is a small spring, so arranged that the cap will fly open unless properly fastened. This eliminates the possibility of leaving the cap open, which would cause the electrolyte to spill out, should the cells be violently agitated by the vibration of the automobile.

Electrical connection between cells is made by means of heavy copper connectors, well nickel-plated. Each connector consists of a solid copper wire, on the edge of which are swedged specially shaped steel lugs which fit over the binding posts and make a taper joint connection with them.

In addition to the testing of the individual cells, which is constantly going on under accelerated conditions of charge, discharge and temperature, the finished cells are placed in banks of sixty, and after being formed, they are repeatedly tested for performance. The cells have now been thoroughly tested both in the laboratory and on the road, and the curves herewith will indicate some of the characteristics which have been discovered.

The table indicates the ordinary performance of the A-6 type of cell.

Charge and Discharge at Normal Rate: 45 Amperes.
Length of Charge, 7 Hours. Discharge Terminated at 1 Volt.

Ampere-hour Input	315.0
Ampere-hour Output	268.5

Ampere-hour Efficiency, 85.2 per cent.

Average P. D. of Charge	1.692
Average P. D. of Discharge	1.202

Volt Efficiency, 71.1 per cent.

Watthour Input	533.0
Watthour Output	322.7

Watthour Efficiency, 60.6 per cent.

Weight of Single Cell: 19.2 Pounds.
Weight per Cell of a Standard Assembled Battery: 20.1 Pounds.
Output per Pound of Cell: 16.8 watthours.
Output per Pound of Battery: 16.05 watthours.
Battery Weight per Horsepower-hour: 46.5 Pounds.

Fig. 4 is a life curve of an A-4 cell, the capacity based on a discharge of one volt. The original capacity at 100 per cent was equal to 171 ampere-hours. This shows the percentage increase over the original capacity over

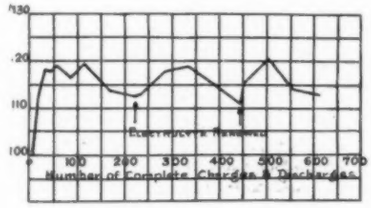


FIG. 4.—LIFE CURVE OF A-4 CELL. CAPACITY BASED ON DISCHARGE TO ONE VOLT. ORIGINAL CAPACITY, 100 PER CENT.=171 AMPERE-HOURS.

a series of 600 complete charges and discharges.

Fig. 5 illustrates the normal rate discharge of an A-4 type cell, which was plotted after it had had 612 complete charges and discharges, and had delivered in all 101,928 ampere-hours, or 122,314 kilowatt-hours, or 8.58 kilowatt-hours per pound of cell. It was charged at fifteen hours, at thirty amperes, and discharged at thirty amperes. The solid line indicates the fifth discharge, and the dotted line the 612th discharge.

Fig. 6 indicates the average variations of voltage with discharge rate, at ninety-three degrees Fahrenheit, for a sixty and sixty-four-cell battery of A-6 cells.

In line with the adaptation of this cell to automobile service there have been developed new ideas with respect to the proper form of body frame and suspension to adapt the storage battery to motor trucks and street railway cars. The light weight of the Edison storage battery has made it possible to re-design the supporting structure and do away with a good deal of weight which necessarily formed a large part of the load to be moved.

For several months the Federal Storage Battery Car Company has been running a single-truck car equipped with the Edison storage battery on the

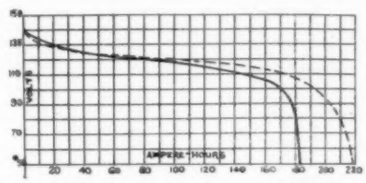


FIG. 5.—NORMAL-RATE DISCHARGE OF A-4 CELL WHEN NEW, COMPARED WITH SAME AFTER IT HAD HAD 612 COMPLETE CHARGES AND DISCHARGES.

Twenty-eighth Street and Twenty-ninth Street Crosstown Railroad, in New York City, giving service to a busy shopping and ferry district. The track conditions are poor, and the rail varies from forty-seven to 109 pounds. The maximum grade is three and one-half per cent, this grade extending over a length of about 1,000 feet. There are forty-six curves in the trip, of varying radii. The length of the route is 4.77 miles. There are an average of eight stops per mile, and an average of 458 stops in a day's run. The car is equipped with two motors, rated at five horsepower, 110 volts, direct current. The storage battery equipment is 100 cells of the A-8 size for driving, and five for lighting. The mileage capacity of car per single battery charge in this

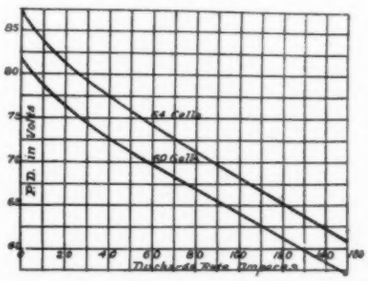


FIG. 6.—VARIATIONS OF VOLTAGE (AVERAGE) WITH DISCHARGE RATE, AT 93 DEGREES FAHRENHEIT, FOR 60 AND 64-CELL BATTERIES OF A-6 CELLS.

service is eighty-six miles, and the maximum speed capacity of the car is fifteen miles per hour. The charging period of the battery is 4.4 hours at 185 volts and sixty amperes.

The seating capacity is twenty-six passengers, with standing room for fif-

teen more, and the weight of the car, complete, is 10,000 pounds, the average load weight being estimated at 2,400 pounds. The car-miles average about 57.25 in a twelve-hour-and-thirty-five-minute day. There is but one battery charge per day, lasting four hours and twenty minutes, with no boosters. The battery intake is 48,840 watt-hours; the consumption per day at the motor brushes, 30,280 watt-hours; the average energy consumption per car-mile, based on the battery intake, 853 watt-hours; the average energy consumption per car-mile at the motor brushes, 528 watt-hours; the average energy consumption per ton-mile, based on battery intake, 137 watt-hours; the average consumption per ton-mile at motor brushes, eighty-five watt-hours.

FIG. 7.—CAR AT CORNER OF BROADWAY AND TWENTY-NINTH STREET, NEW YORK CITY.

There have been no interruptions to service, no repairs to car body, motors, motor brushes, controllers, cables or lighting wires, and no repairs to the track, wheels, axles, journal-brasses, brake-shoes, or to the battery.

The battery has been refilled with seventy gallons of distilled water, without the necessity of adding caustic potash.

The car left the factory on March 2, and up to July 6 made 10,843 car-miles, the weather ranging from cold, snow, sleet and rain to warm and clear, with the track generally dirty and slippery.

A Municipal Exhibition.

At the forthcoming convention of the League of American Municipalities, to be held at St. Paul, Minn., August 23-26 next, a municipal exhibition will be held which will include "everything from electric light plants to pencils."

Electrical Exports for May.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has issued its monthly summary of imports and exports for the month of May. From this the following facts relative to the electrical exports from this country for that month are taken.

The month of May was a record-breaking one in the matter of electrical exports. The total exceeded any previous month, chiefly because the exports of electrical appliances (including telephone, telegraph and other instruments) broke all previous records; the exports of electrical machinery were quite heavy also, nearly as great as any month for several years. For the last two months the exports of appliances have practically doubled the figures of the corresponding months last year. These heavy shipments, along with the more spasmodic revival of machinery exports, are bound to make the fiscal year, which closed June 30 last, practically equal the hitherto banner year 1907-8.

The comparative monthly data are as follows:

Electrical—	May, 1910	May, 1909	April, 1910
Appliances	$1,025,549	$539,424	$959,186
Machinery	684,938	479,951	484,658
Total	$1,710,487	$1,019,375	$1,443,844

The principal countries to which electrical products were sent last May, together with the values of these exports, are as follows:

Exported to—	—Electrical— Appliances.	Machinery.
United Kingdom	$ 72,126	$ 42,564
Belgium	5,782	.....
France	6,449	21,299
Germany	7,189	13,879
Other European countries	6,933	44,536
British North America	292,303	155,954
Central American States and British Honduras	48,964	18,521
Mexico	153,971	97,834
Cuba	26,705	9,877
Other West Indies and Bermuda	7,504	6,963
Argentina	33,506	4,159
Brazil	225,996	8,951
Other South American countries	31,672	21,099
British East Indies	.....	9,647
Japan	73,188	155,601
British Australasia	11,361	30,671
Philippine Islands	4,239	26,061
British Africa	11,742	13,235

Lease Brooklyn Subway Extension.

The New York Public Service Commission recently received a letter from Frederick W. Rowe of the Manhattan Bridge Three Cent Line, M. E. Harmon, William C. Demarest, and Henry Roth, urging that a subway along Flatbush Avenue from Atlantic Avenue to Eastern Parkway, and Livonia Avenue to New Lots Road, and also a branch southerly on Utica Avenue and Nostrand Avenue be constructed at once. These four men agree that in such case they will take a lease to operate this subway, paying interest on the sinking fund of one per cent on the cost of the Flatbush Avenue portion, and a nominal rental for the balance. Should the proposition be favorably considered, they will organize a company in a form or in such form as will be satisfactory to the commission and the Board of Estimate, and make the necessary formal applications to obtain this lease.

Ohio Electric Light Association.

Final arrangements for the sixteenth annual convention of the Association to be held at Cedar Point next week have been made, and the following programme will be carried out:

Tuesday, July 26, 9:00 a. m.—Meetings of all committees. 10:30 a. m., Business meeting with President's address. 2:00 p. m., Reading of following papers: Low Pressure Turbines and Their Operation, by W. C. Anderson; Turbine Troubles, by Frank Brosius.

Wednesday, July 27, 9:00 a. m.—Reports of Committees and following papers: Motors for Single Phase Circuits by Prof. F. C. Caldwell; Progress in the Introduction of Electric Vehicles, by J. T. Kermode; Methods in Getting New Business in Cities of 15,000, by L. A. Petit, Jr. 2:00 p. m., Series Tungsten Lamps for Street Lighting, by Claude Smith, C. C. Custer, and Frank Jackley; Tungsten Lamps vs. Central Station Earnings, by E. L. Booth.

Thursday, July 28, 9:30 a. m.—Central Station Facts and Factors, by J. R. Cravath; Outline of an Equitable Power Rate, by B. H. Gardner. 2:00 p. m., Election of Officers and Appointment of Standing Committees; Methods of Maintaining Electric Meter Accuracy, by John Gilmartin; Best Methods in Purchasing Station Apparatus, by R. J. Feathers.

The entertainment features include a dinner Tuesday evening, followed by musicale and cards and a trip on the Lagoon; a banquet and grand ball on Wednesday evening; a theater party on Thursday evening; special musicales, card parties, bowling and launch rides for the ladies during the day. The entertainments are all complimentary, no subscriptions being necessary to any of the functions. Great credit is due to E. H. Beil, acting president, and D. L. Gaskill, secretary, for making the arrangements for the meeting.

THE USE OF STORAGE BATTERIES IN DIRECT-CURRENT AND ALTERNATING-CURRENT CENTRAL STATIONS.[1]

BY R. WERKNER.

In order to select the most suitable generating system when building a new central station, it is necessary to take into account not only the first cost of installation and distribution, but also the different operating expenses which different systems call for. Operating expenses can always be more or less lowered by the use of storage batteries and their relation to the different systems of generation and distribution will be discussed. In alternating-current work the three-phase system only is treated, leaving out of consideration steadiness of operation, overload capacity, etc. Operating expenses may be divided in the following items: (1) Interest and depreciation. (2) Fuel. (3) Wages. (4) Maintenance. (5) Oil, waste and small supplies.

Direct-Current Generation and Distribution.—In a direct-current central station furnishing light and power the introduction of storage batteries allows of cutting the daily machinery run from twenty-four to ten or twelve hours. It must be noted though, that the author considers direct-current only suitable for small central stations, where the storage battery takes up the peak and the total minimum night and day loads.

A. First Cost of Installation. If the load on the battery is not very heavy, so as not to require a large storage capacity, and lasts only for a short period of time, the installation cost of a storage battery is lower than the installation cost of a corresponding capacity in boilers, engines, and dynamos. But if the load diagram is such that it would be necessary to have a storage battery of a very large capacity, then the first cost with battery is larger than the first cost without.

B. Operating Expenses. (1) Interest and depreciation. Manufacturers guarantee a storage battery for a twenty-years' life, which with an interest tax of five per cent gives a depreciation rate of about eight per cent per year on the supplementary first cost of installation. In the cases where the central-station first cost is larger with battery than without battery, eight per cent on this difference does not amount to a sum worth considering. (2) Fuel. By a rough calculation the author shows a thirty-four per cent economy in fuel for the station with a storage battery. (3) Wages. The cutting down of the length of run of the generating machinery enables the cutting down by half of the pay-roll. (4) Maintenance. The cost of maintenance is proportional to the length of run and to the size of the generating machinery, consequently it is less for a small machine running ten or twelve hours per day than for a large machine running twenty-four hours. But the maintenance cost of a storage battery is greater than this difference in the machinery maintenance cost, which makes the total maintenance cost larger for the central station with battery than for the one without.

(5) Oil, waste, etc. The economy on this kind of material may in a small installation make up for the larger maintenance cost of a storage battery, so as to leave the economy in fuel and wages totally clear. The same may be said for large installations, and it is safe to consider the installation of a storage battery a good economic policy.

Alternating-Current Generation and Distribution.—Comparing the operating expenses of an alternating-current central station with a direct-current station without battery it may be said *a priori* that the annual expenses for wages, maintenance, lubricating materials and waste are equal in the two cases. In regard to the fuel cost it may be said that the energy losses when working twenty-four hours per day are also equal in the two cases. The energy losses in the customers' distribution systems are also equal and the losses in the primary distribution system are some per cent lower in the alternating-current high-tension lines than in the direct-current transmission lines.

But for the alternating-current central-station, transformer losses must be added. For a maximum load utilization of the station for a period of 900 hours per year those losses amount to about thirty-six per cent of the total annual output. They may be decreased by increasing the total time of maximum load utilization, by disconnecting those transformers which are not actually in service, and by using a few large transformers instead of many small ones. This loss percentage is consequently smaller in stations furnishing energy for light, power and traction, than in stations which only take care of a lighting system.

If instead of effecting the distribution by means of individual transformers, a secondary system of distribution is used and all the transformers are connected in parallel, then the transformers can be designed not for the total output but for the average output and transformer losses are decreased. In Germany, from statistics, the transformer losses amount in the average to from fifteen to twenty per cent of the total annual output.

From the preceding, fuel expenses in an alternating-current station are larger than in a direct-current station without battery, while the other operating expenses are equal. Moreover, as the installation of a storage battery in a direct-current station will cut down the total operating expense, a direct-current storage battery station is from the operating-cost point of view far superior to an alternating-current station. Consequently, with equal cost of installation and equal annual charges for interest and depreciation, a direct-current storage battery is superior to an alternating-current station.

Lately the introduction of metallic-filament incandescent lamps has temporarily given an advantage of current economy to the alternating-current station, as those lamps could more easily be used for low-tension alternating currents than for the customary tension of 220 volts direct. But good lamps for 220 volts have been obtained and this advantage tends to disappear.

Three-phase Alternating-Current Station.—Would it be of advantage to add a storage battery to an alternating-current central station to cut the running time to ten or twelve hours per day and have the battery take care of the peak and night and day minimum loads while the central station would only furnish three-phase current to the distributing system?

In the simplest case the installation cost in comparison to the one of a direct-current station is increased by the converting apparatus and the operating expenses are larger on account of larger fuel cost resulting from the energy losses in the double transformation. As the efficiency of a motor-gen-

1 Abstracted and translated from *Elektrotechnik und Maschinenbau*, January and February, 1910.

erator set is at variable load about eighty-five per cent, the battery gives back to the system only about fifty-four per cent of the total energy that it takes from the generating system for its charging and if the battery is supposed to furnish thirty per cent of the total output then fifty-five per cent of the total consumption is used for the charge and the battery losses reach twenty-five per cent of the total useful power.

From the same fuel calculations that he follows in the direct-current case, the author finds for a storage battery in a three-phase central station a fuel economy of twenty-six per cent, which is eight per cent lower than in the direct-current case, due to the converter losses.

The total operating economy would then be a little lower than in a direct-current station, but it would probably reach a not indifferent amount. This total may be still increased by the use of rotary converters which have a higher operating efficiency than motor-generator sets, or by directly connecting to the engine and alternating-current generator a direct-current dynamo which would, during the day, charge the battery, using the excess steam power at low load, and at maximum load periods would (run by the battery as a motor) help the engine in taking care of the alternating-current generator load. In this case the transformation losses are cut by half.

Although for a running time of ten hours storage batteries are economical, when there is no day load those economies in operation obtained by the employment of batteries disappear, and the battery as a substitute to running machinery cannot be used when there is a power load. A twelve-hour machinery run is not possible in large towns where the day load is heavy. The battery would then have to be of too large a capacity, and the installation cost, interest, depreciation and maintenance charges would be considerably increased.

In such a case it is better policy to design the central station for a continuous day run and limit the battery to peak-load service.

Generally the load factor is, on a twenty-four hour service, for a direct-current station forty-two per cent and for an alternating-station, forty-six per cent, which gives a comparative increase of ten per cent in the required capacity to take care of converter losses.

With an all-day service, at uniform load, the installation cost and the interest, depreciation and maintenance charges are smaller than they are in a station designed for a twelve-hour run. Salaries, oil, waste, etc., are larger and the amount of fuel used is just about the same, but to render the station profitable the output must be kept as high as possible, and all of it must be sold.

The equilibrium of load which a battery in a direct-current station allows, assures an increase in profits.

In a three-phase station, the use of storage batteries is very restricted. A fuel economy will result if in their use the energy losses due to converting apparatus and battery will be smaller than the losses of machinery running at no load. Such is the case when only one machine of total load capacity is used. When two machines are used, an economy will be realized by the installation of a storage battery only when the day load is such that one machine is not enough and two run under unfavorable load conditions. The battery then reestablishes favorable load conditions, and as, from three-phase central-station statistics, it has been found that in summer the generation of a kilowatt-hour may require fifty per cent more coal than in winter, on account of load difference in the two systems, then the battery used in connection with one machine for summer output may at the end of the year show a large fuel economy. A battery may also be useful in a central station where two machines can care for the average load, and the peak is only slightly larger than the total machinery capacity, for a third machine would be wasteful. Hence in many cases a storage battery is also useful in three-phase station.

Alternating-Current Generation and Direct-Current Distribution.—In large cities an alternating-current central station combined with rotary-converter substations is common. The storage batteries are distributed in the substations and operated in parallel with the converters. Then the high-tension transmission system can be designed to take care only of the average load as the batteries take care of the peak and minimum light loads. To decrease the cost of installation of the direct-current transmission lines, highly charged balancing storage batteries are installed in secondary distributing centers. The direct-current cables then only carry the substation average load and not the maximum.

A. Cost of installation. The central-station generating machinery and the substation converters can be of a smaller capacity. The cost of the alternating-current and direct-current transmission lines is smaller.

B. Operating expenses. Interest and depreciation charges are decreased. The amount of savings on other operating expenses is equal to the one obtained in a simple direct-current system with storage batteries.

Comparing this system with a purely three-phase alternating-current system without battery it can be seen that the first,—on account of the introduction of the substations, has a larger item of cost for maintenance and wages, while the fuel cost is less as the central is operated under favorable load conditions and there are no transformation losses. The system is to be favored in towns where fuel expenses are a more important factor than wages and maintenance.

Telephone Merger in Indiana.

The Laporte Electric Company and the Laporte Gas Light Company are included in a merger with the Cedar Rapids (Ia.) Gas Light Company, the Fort Dodge (Ia.) Light Company, the Muscatine (Ia.) Light and Traction Company, the Cadillac (Mich.) Gas Light Company, the Mattoon (Ill.) Gas Light Company, and the Chattanooga (Tenn.) Gas Company, under the name of the United Light and Railways Company, capital stock $30,000,000.

The merger company will act as a holding company for the Childs-Hulswit syndicate of Grand Rapids, Mich., which owns a controlling interest in the corporations included in the merger.

Chicago Electric Club Picnic.

The Chicago Electric Club has made announcement, through Secretary F. S. Hickok, that the annual picnic of the club will take place at Ravinia Park on Saturday, August 6.

Donations for prizes are solicited, the same to be sent to George H. Porter, chairman of the entertainment committee, 500 South Clinton Street.

STANDARD SPECIFICATIONS FOR TRANSFORMERS.

ISSUED BY BUREAU OF STANDARDS.

The Bureau of Standards has recently issued Circular No. 22, containing "Standard Specifications for Transformers, Oil-Immersed, Self-Cooled, Sixty-Cycle, 2,200-Volts," which have been prepared with the co-operation of government engineers and manufacturers. They are accompanied by notes which explain the application of the tests, and the reasons for some of the requirements. Copies of the specifications can be obtained by request addressed to the Director, Bureau of Standards, Washington, D. C. The specifications follow:

PROPOSALS.

1. Bidders shall include in their proposals complete information with reference to the following characteristics of the transformers which they offer, and no bid will be considered with guarantees inferior to those specified in Table I: Core loss; copper loss under full load; efficiency; regulation; weight; dimensions (sketch or drawing).

These data shall apply to a temperature of twenty-five degrees centigrade. All other factors being equal, preference will be given to the apparatus having the best performance characteristics.

GENERAL.

2. *Type, Frequency, and Voltage.*—These transformers shall be either of the shell type or of the core type; shall be oil-immersed and designed for operation on sixty-cycle circuits. The primary voltage shall be 2,200, and the secondary shall be so arranged that either 110 or 220 volts may be obtained with 2,200 volts on the primary.

3. *Materials and Workmanship.*—The materials entering into the construction of these transformers shall be of the highest grade, and of a quality and character best suited to the purpose in hand. The workmanship shall be first class in every respect and shall meet with the approval of the representative of the purchaser.

4. *Rating.*—Transformers shall be rated at the number of kilowatts which they can deliver without exceeding the specified rise of temperature when operating at unity power factor and under normal conditions of frequency and secondary voltage.

5. *Name Plate.*—Each transformer shall bear a name plate, which shall state name of maker, serial number, type, and kilowatt capacity of the transformer, also the primary and secondary voltages and the frequency for which the transformer is designed.

DETAILS OF CONSTRUCTION.

6. *Cases.*—Transformer cases shall be made of cast iron or of sheet iron fastened to cast-iron bases in a satisfactory manner and provided with cast-iron covers. Eyebolts or hooks shall be provided for handling the transformers filled with oil. Cases shall be free from leaks, and shall be impervious to oil. Covers shall be provided with felt or other suitable gaskets. The cases of all transformers above five kilowatts capacity shall be provided with oil plugs for removing the oil from the case. Oil gauges shall be provided for any individual case where conditions render their use expedient, and in such instances they will be separately specified.

7. *Hangers and Cut-outs.*—Unless specified to the contrary, transformers up to fifty kilowatts shall be provided with hanger irons for supporting the transformers when mounting same on poles. Two plug cut-outs shall be provided for the high-tension side of each transformer.

8. *Leads and Connection Boards.*—Four secondary leads shall be brought out of the case through porcelain bushings, which shall be sealed into the case with a suitable compound which will not soften sufficiently to flow at any temperature less than ninety degrees centigrade. Two primary leads shall be brought out in a similar manner. The ends of the primary coils shall be brought to a convenient connection board of porcelain or other suitable material within the case, and so arranged that the primary coils may be put in series or in multiple.

9. *Core.*—The core shall be built of laminated sheet steel, so firmly assembled that no buzzing is perceptible, and shall be non-aging. At the option of the purchaser an artificial aging test may be made upon a sample of the core material or upon a finished transformer.

10. *Windings and Insulation.*—The primary coils shall be insulated from the secondary by a shield of ample dielectric strength. Each turn shall be thoroughly insulated, and the voltage between adjacent turns kept as low as is consistent with good design. Coils shall be carefully taped and leads shall be brought out in a thoroughly workmanlike manner. Coils shall be dried by the vacuum process, and impregnated with an insulating compound which is not hygroscopic and not soluble in nor acted upon by the transformer oil at operating temperatures, or else the insulating material used shall be moisture-proof. The windings shall be so disposed as to permit the free circulation of oil and the maintenance of a nearly uniform temperature throughout.

11. *Oil.*—The oil used in these transformers shall be a pure mineral oil obtained by the fractional distillation of petroleum, unmixed with any other substance. It shall be prepared and refined especially for the purpose, and shall be free from moisture, acid, alkali, and sulphur compounds. The flash point of the oil, determined in a closed cup, shall be not less than 170 degrees centigrade, and on cold test it shall not begin to solidify, and no wax shall form in the oil above zero degrees centigrade.

Sufficient oil shall be furnished to completely immerse core, windings, and connection board.

The oil shall withstand a breakdown test of 30,000 volts between spherical surfaces of 0.5 centimeter radius, 0.40 centimeter apart.

TESTS AND PERFORMANCE.

12. *Inspection Requirements.*—All transformers will be tested at the place of manufacture, in the presence of a representative of the purchaser, if the latter so desires. The contractor shall give ten days' notice to the purchaser of his readiness to make the specified tests, and shall furnish all labor, materials, instruments, observers, complete facilities for tests, including those enumerated in paragraph No. 14, and such information regarding the transformers as is available without additional tests, as the purchaser's representative may consider necessary for a definite opinion of their acceptability. He shall permit the representative to examine the transformers at all times from the beginning of their manufacture. The results of all tests specified herein shall be given by the manufacturer to the purchaser or his representative in the form of a certified report.

13. *Description of Tests.*—The following tests will be made upon all of the transformers:

(*a*) *Design, Materials, and Workmanship.*—Action upon these features will be based on the requirements of the specifications and observations made while the apparatus is under test.

(*b*) *Core Loss.*—Core loss and exciting current shall be taken cold at approximately twenty-five degrees centigrade. Core loss shall be measured with a wattmeter at normal frequency and voltage, using power from a generator giving a sine wave, when such is available. When a pure sine wave is not available, it shall be permissible to use any wave form which comes within the A. I. E. E. definition of a sine wave, adjusting the test voltage so that the core loss will be the same as with normal voltage and sine wave. Where voltage cannot be regulated by excitation of the generator, it must be done with auto-transformers and not by rheostats in series with the transformer to be tested. The average of the core losses of the full number of transformers of the same size on one order shall not exceed the value stated in the proposal, and the maximum core loss must in no case exceed this value by more than ten per cent.

(*c*) *Exciting Current.*—The exciting current, as observed during the test for core loss, shall in no case exceed ten per cent of the full load current, and for transformers of ten kilowatts or larger, shall not exceed eight per cent of full load current. With an applied voltage ten per cent above normal, the exciting current shall not exceed twenty per cent of the full load current.

(*d*) *Copper Loss.*—The copper loss shall be determined by separate measurements of primary and secondary resistance at or corrected to twenty-five degrees centigrade. The average copper loss of the full number of transformers of the same size on one order shall not exceed the value of copper loss given for that size in the proposal, and the maximum copper loss must in no case exceed this value by more than ten per cent.

(*e*) *Regulation.*—The regulation shall be computed from the measured resistances and the reactive drop of voltage, using the following expressions.

For unity power factor:

$$\text{Per cent regulation} = \frac{100\ I\ R}{E} \qquad (1)$$

For sixty per cent power factor:

$$\text{Per cent regulation} = 100\ \frac{0.6\ I\ R + 0.8\ P}{E} \qquad (2)$$

where E is the rated primary voltage, P the reactive drop of voltage, I the full load primary current (not including exciting current). The equivalent resistance, R, of primary and secondary combined, is found by multiplying the secondary resistance by the square of the ratio of turns, and adding to the primary resistance.

The impedance voltage, e, is found by short-circuiting the secondary winding, and measuring the voltage necessary to send full-load current through the primary. The reactive drop is then computed from the expression

$$P = \sqrt{e^2 - I^2 R^2} \qquad (3)$$

The per cent regulation computed in this way shall not exceed the values given in Table I. Under conditions of maximum unbalancing, that is, with full-load current on one side and no load upon the other side, the difference in voltage shall not exceed the stated per cent regulation.

(*f*) *Heating.*—The two transformers of each size whose combined core and copper losses come nearest to the values stated in the proposal shall be selected for a heating test of that type and size. They may be overloaded and overexcited to hasten the

rise of temperature to the ultimate value under constant full load, and the final temperature in any part, maintained for one hour under constant full load and normal voltage and frequency, shall not exceed the temperature of the room (corrected to twenty-five degrees centigrade) by more than fifty degrees centigrade. The rise of temperature shall be determined by the increase of resistance of the windings and by thermometer in the oil, placed as directed by the representative of the purchaser, and the highest indicated temperature shall be taken to determine the rise.

If the test be not made with sine wave and rated frequency, the applied voltage shall be adjusted to make the core loss the same as when operating on sine wave of normal voltage and frequency. The load current in amperes shall be based upon rated volts and watts.

The transformers may be loaded with a noninductive load, or they may be subjected to loading conditions by the opposition method.

The rise of temperature of other transformers of the same size and type shall be computed from the sum of core and hot copper losses on the assumption that the temperature rise is proportional to the combined losses. The hot copper loss shall be computed on the assumption of a proportional increase over the cold copper loss, equal to the average proportional increase in the two transformers subjected to heating test.

Any transformer in which the computed temperature rise exceeds the above limits shall be rejected, or, at the option of the manufacturer, subjected to an actual heating test.

(*g*) *Insulation.*—The transformers shall withstand for one minute an alternating electromotive force of 10,000 volts, sixty cycles, between primary coil and core, case and secondary coil, and 4,000 volts between secondary coil and core and case. Transformers shall also withstand for one minute twice the rated voltage applied to the primary coil. These tests are to be made before oil has been put in the cases.

At the end of the heating run, the insulation tests shall be repeated upon the two hot transformers while filled with oil.

MANUFACTURER'S FACILITIES.

14. The manufacturer shall provide complete and suitable equipment for making tests, which shall include the following:

(*a*) A source of supply of approximately sine wave and rated frequency.

(*b*) Means for tracing wave forms or determining the correction necessary in order to get sine-wave results.

(*c*) Means for determining the frequency, by tachometer connected to the generator, or by frequency meter of the vibrating-reed type.

(*d*) Calibrated instruments of suitable capacity for measuring watts, volts, and amperes.

(*e*) Apparatus for accurate measurement of resistance, preferably by the drop of potential method.

(*f*) Apparatus for high-potential insulation tests, including spark gap for measurement of applied voltage.

(*g*) Facilities for flash point, evaporation, dielectric strength and cold tests of transformer oil.

(*h*) Suitable means for loading transformers by opposition, or else water rheostats or lamp banks for direct noninductive loading.

BASIS FOR COMPARING GUARANTEES.

15. In case the proposals offered by different bidders in accordance with these specifications guarantee core losses less than those specified in Table I, each watt of difference shall be evaluated at $0.88 for purposes of comparison. For the same purpose, copper loss shall be evaluated at $0.33 per watt for each watt difference between values specified in Table I and the full-load value guaranteed by the bidder.

REJECTION OPTIONAL.

16. In case transformers submitted under these specifications show upon test average core or copper losses in excess of those stated in the proposal, the purchaser shall have the option of accepting them at a reduction from the price bid, the reduction to be determined by making the same allowance per watt for the excess loss as specified under section 15.

TABLE NO. I.
MAXIMUM CORE AND COPPER LOSSES.

Rating in Kilowatts	Core Loss in Watts	Copper Loss in Watts at Full Load	Per Cent Regulation Power Factor =1.00	Per Cent Regulation Power Factor =0.60
1	21	26	2.6	3.1
1.5	26	36	2.5	3.1
2	30	46	2.4	3.1
2.5	33	55	2.3	3.1
3	36	64	2.2	3.1
4	41	80	2.1	3.2
5	45	93	2.0	3.2
7.5	64	125	1.9	3.2
10	82	160	1.7	3.2
15	110	216	1.6	3.2
20	135	280	1.5	3.2
25	160	323	1.4	3.2
30	175	374	1.3	3.2
40	210	470	1.2	3.2
50	255	580	1.2	3.3
75	400	875	1.1	3.3
100	560	1000	1.0	3.4

An appendix entitled "Notes to the Specifications" is included in the original circular, but is omitted here for want of space.

Chemical Effects of Ultraviolet Rays.

In a paper presented to the Paris Academy of Sciences, Messrs. Berthelot and Gaudechon describe some remarkable chemical effects which are produced by exposing gases to ultraviolet rays coming from a quartz mercury-vapor lamp. Carefully dried gases contained in small quartz tubes are exposed near the lamp. The first experiments described by the authors relate to polymeric effects. Pure acetylene gas is submitted to the action of the lamp for one hour at 0.8 inch distance and for two hours at greater distances. After a short time we observe a cloud in the tube, and a solid layer begins to form upon the sides. Its thickness increases and it has the coloration which is characteristic of thin layers. The chemical action is very rapid at first, but then becomes slower, as the deposit hinders the ultraviolet rays from passing into the tube. The precipitated solid matter is of a yellow color and has the special odor of polymers of acetylene which are obtained usually by the action of a brush discharge upon the gas. There is, however, no decomposition of the acetylene. The present action, like those which are due to ionization of gases, is favored by lowering the pressure of the gas, seeing that this makes the gas a better conductor. Adding an inert gas also gives a better effect, as was seen in a second experiment. Hydrogen and acetylene mixed were exposed in a quartz tube (such tubes are but 0.02 inch thick). The tension of the acetylene was now about half what it was before, and its contraction due to the rays is thirty-three per cent instead of sixteen per cent. All the hydrogen is found unchanged. The sides of the tube are covered with a yellow deposit. Nitrogen acts as an inert gas in the same way. Another experiment was made upon ethylene gas, and we have a contraction of eleven per cent. A polymer is formed which has the appearance of an oily liquid, with a rancid odor. This body resembles caprylene and similar bodies which are obtained when wax is decomposed by heat. The residual gas in the tube is pure ethylene. Goriainoff previously tried to polymerize ethylene, but without result. Cyanogen is another gas which was used. In a few seconds a solid deposit of brown color is formed on the tube. This body is para-cyanogen. It soon stops the action of the rays. The rest of the tube contains cyanogen, as before, and it is seen that in all the present experiments there is a polymeric effect, but not a decomposition. In an experiment upon oxygen, ozone is formed in the tube. The contraction is here only 1.7 to 2.8 per cent, the latter for a three-hours' exposure at 0.8 inches from the lamp. The gas has the well-known odor of ozone. The formation of ozone by ultra-violet rays takes place in but a small proportion, and this explains why the action was denied by some observers. From the above tests, however, this can no longer be doubted.

Electric Strength of Argon.

At a meeting of the Academy of Sciences in Paris on June 20, E. Bouty read a paper describing a new measurement of the electric strength of argon. This determination is attended with difficulties which do not arise in the case of the other rare gases. For a fixed pressure, for no apparent cause, there are progressive variations in the minimum difference of potential capable of causing the discharge. By making two consecutive measurements rapidly at widely different pressures this difficulty is partly got over. The strength of argon was finally found to be practically double that of helium.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

ALTERNATING-CURRENT INDUSTRIAL POWER-PLANT SWITCHBOARDS.—I.

BY WARREN H. MILLER.[1]

In these days when shop and tool drive by three-phase induction motors of both constant and variable speed is becoming so much used, because of the simplicity and ease of upkeep of the induction motor, the adoption of alternating current for the light and power of new works often comes under consideration. An objection sometimes raised is that cranes and variable-speed tools such as bending rolls, etc., do not do well on alternating current, but it is becoming more and more realized that both cranes and variable-speed tools operate quite as satisfactorily on alternating current, with which controller troubles are very much less, and commutator and brush repairs are of course eliminated. Indeed, the writer's own experience with alternating-current cranes for all classes of shop services, including foundry and boiler-shop work, of all tonnages up to 120, and variable-speed tool motors up to forty horsepower, has been that the alternating-current motors are capable of just as fine and close work, and that the upkeep and repair account is far less. In lighting, alternating current is more flexible and inexpensive in its possibilities, because it permits the use of isolated-pole transformers, and avoids all heavy low-tension light mains. In the power house the repair and expense account is also in favor of alternating current, but one often hears the point raised that the swtichboard is much more complicated. Works managers and industrial engineers are the ones called on to decide as to what kind of electric power shall be used, and the facts on all these points should be well thrashed out, so as to arrive at a decision that will not later be regretted. It is the purpose of this article to show what can be done with simple alternating-current boards for various classes of industrial-plant service. Beginning with small light panels with one generator, the illustrations show alternating-current boards for a number of industrial plants, up to a forty-two-foot board recently designed by the writer for a large oil refinery, this latter having three station panels, five generator and ten feeder panels.

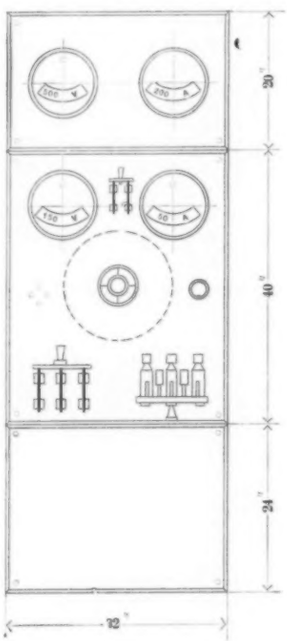


FIG. 1.—CONTROL BOARD.

In all of these boards down to the smallest, there are a few instruments which may be classed as indispensable. The board shown in Fig. 1, controlling a sixty-five-kilowatt alternating-current belted generator, with a six-kilowatt exciter, is reduced to about the least possible number of instruments. This board was used in a large boiler shop, before the main power house was built for all the shops in the works. The future generators were to be 480-volt, twenty-five-cycle, three-phase, and, so as to run the crane, bending rolls, isolated tool motors and all the electric lighting at that time installed, it was decided to buy the steam exciter for the power house ahead of the main generators, and install it temporarily in the boiler shop. To get the proper current, the alternator was installed and belt-driven off the flywheel of the exciter, and controlled by this panel. The exciter set was a thirteen by twelve-inch, Harrisburg, side-crank engine, direct-connected to a 62.5-kilowatt Westinghouse, 110-volt, direct-current generator. One thus had immediately available some forty kilowatts of both direct and alternating current, up to the limit of the engine, which was about eighty kilowatts.

The exciter was moved later to the main power house, the job taking two days from the time the throttle was closed in the boiler shop until it was opened again in the power house, the excitation being supplied in the meantime by the motor-generator spare exciter. To show how all such temporary apparatus can be worked in about the plant, this panel is now in on the main board, feeding and metering the station auxilary apparatus. The belted alternator went down to the power house with the steam exciter, where it parallels with the big engines, and is very useful when the load is a little too heavy for two engines and not enough for three; and the little belted six-kilowatt exciter runs off a shop shaft, as a generator for charging the telephone central storage battery, running the ceiling fans in the main offices, and other small isolated direct-current work about the plant.

Specification of this panel is as follows:

Top section, twenty inches by thirty-two inches.
- One 600-volt, Weston alternating-current voltmeter.
- One 200-ampere Weston alternating-current ammeter.
- One lamp bracket.

Middle section, forty-eight inches by thirty-two inches.

1 Electrical Engineer, Standard Oil Company.

One 150-volt, Weston direct-current voltmeter.
One fifty-ampere Weston direct-current ammeter.
One quick-break fifty-ampere double-pole, single-throw knife switch.
Synchronizer and voltmeter plugs.
Concentric generator and exciter rheostat handles.
One three-pole, single-throw, 200-ampere Walker knife switch.
One three-pole, type W, Cutter inverse time-element circuit-breaker.
Bottom section; twenty inches by thirty-two inches.
Blank.
Board of two-inch purple Vermont slate, black enamel finish, one-half-inch bevel edges, mounted on 2.5 by 2.5 by 0.25-inch angle iron frame. Built by the Walker Electric Company of Philadelphia; cost, about $160.

The crane and bending-roll circuit came off the three-phase circuit-breaker, and the three lighting circuits were tapped in back of the main switch, the pairs of leads going directly to ordinary sixty-ampere, iron-clad cartridge-fused, two-pole knife switches. Though the current is three-phase, a single ammeter in one leg is plenty, as any reasonable judgment will balance the lighting circuits sufficiently. In fact it does no real harm if one whole phase of the lighting circuit carries practically no current, as the unbalancing simply deteriorates the efficiency somewhat. The two direct-current exciter instruments are indispensable, though a lamp could be used in place of the voltmeter. The concentric mounting of exciter and generator rheostat handles is a good feature and standard, requiring no special designs. It puts the whole control compactly under one hand. The exciter rheostat, and button-contact slate of the generator field, mount right on the back of the board, in all sizes of generators, and eighteen inches should be allowed clear if practicable around the handle so as to avoid the necessity of sprocket wheels and chains. The resistance grids come in separate frames, and in small boards are conveniently mounted on the wall, back of the board, with a galvanized hood, to keep off dust. The instruments are all Weston, standard alternating-current switchboard type, correct to within about half of one per cent, costing not over $20 in ordinary sizes, and accurate enough for amperages up to 1,000 and voltage up to 600. The expensive type F Westinghouse instruments are somewhat too fine for small boards, but the Westinghouse company also makes a cheaper instrument (type K) for industrial plant work. The seynchronizer plug and lamp were put on for use in case the generator would be paralleled with others, or used as a synchronous motor.

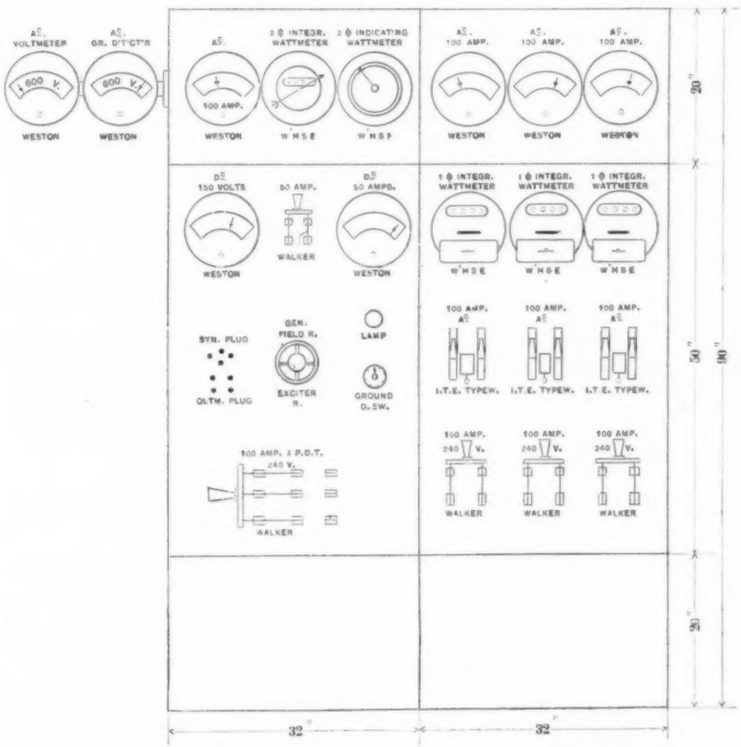


FIG. 2.—DIRECT-CURRENT AND ALTERNATING-CURRENT PANELS.

These actually were so used for several months, being connected to the nearest three-phase feeder line, and the circuit paralleled with the power-house generators without trouble, in spite of being in another building half a mile away.

Regarding materials for boards, Pennsylvania slate will do to specify for low voltages around 110, and is cheap. For direct-current at 250 and 500 volts and alternating-current at 240 and 480 volts, either purple or green Vermont slate is excellent, and costs about $15 less per panel than marble. If given a polished, black-enamel finish it makes a fine appearance, contrasting and setting off the polished copper switches and breakers. It is also easily cleaned and does not look dirty if a trifle neglected. In the author's opinion, the only equal of it is fine white Italian marble, as the various red Tennessee and blue Vermont marbles always look dirty and old if the least oil or dust gets on the board.

The next larger alternating-current board would be the generator and lighting panels shown in Fig. 2. This board was designed by the writer to go with two 200-kilowatt, 480-volt, three-phase, sixty-cycle generator panels, hence the double-throw main switch. The two big machines fed a power panel which had such large motors connected to it that starting and stopping them would seriously affect the lighting system, so the light was furnished by a separate fifty-kilowatt, direct-connected alternator driven by a twelve-inch by twelve-inch Harrisburg engine. In case of shutdown of the latter, the double-throw switch could put the light buses in with the big power turbines. The equipment of this board is also limited to exactly the necessary instruments for feeding and measuring the electric current, for the swtichboard is not only the eyes of the electrical department, but also its business and,—the cash register, as it were. So there will be, in addition to the four indispensables, a ground detector voltmeter out on the swinging bracket, an integrating wattmeter and an indicating wattmeter on the generator panel. Neither of these latter are necessary unless the machine is to run in parallel with others when the indicating is needed to tell at all times just what the alternator is doing and whenever it is taking too much load

or else is being "motored" by the other machines.

The integrating meter was put on to charge out current generated for power, which could be calculated by subtracting the totals of the single-phase light feeder wattmeters. The indicating wattmeter is the Westinghouse type F, costing about $150. It should be put out in the swinging bracket, if used at all in small boards, because it requires a nine-inch hole cut in the slate to mount it. But, as the eight leads to it are all small secondaries of little 100-watt meter transformers, it can go out in the bracket without inconvenience. The integrating meter is the round switchboard type, a very handsome instrument mounting on the face of the board. It reads down to ten kilowatt-hours on the large dial and up to 1,000,000 kilowatt-hours on the small dials. It likewise has four voltage and four current transformer leads from two of the three phases, and is run off the same transformers as the indicating meter. Both wattmeters give the true energy of the three-phase system, regardless of unbalancing or power factor. One may also question the necessity of the ground detector voltmeter, as this could be arranged with a three-point switch to connect the bus voltmeter to the ground. The explanation would be that it is simply a crotchet of the writer's, and there will be found an extra voltmeter on any board designed by him, doing duty as a ground detector, because this instrument is particularly vulnerable, both in alternating and direct-current work. Hardly a severe thunderstorm occurs without one or more voltmeters being put out of business, principally in the fine resistance coils sent with each instrument, of whatever make. If there is no spare, the plant is "down and out," so to speak, until another one can be secured. If the ground detector voltmeter is available, the pressure is known again in about five minutes.

Turning to the light panels, the three phases have a circuit between each, branching out behind the board and entering the switches at the bottom of the panel; thence through a two-pole, Cutter, Type EL, inverse-time-element breaker and out to the lines, one leg passing in series through the Westinghouse Type C, single-phase, 480-volt integrating wattmeters and through the Weston 100-ampere ammeters. In all other respects this board is of the same general specifications as the single-panel one first described. The cost is about $700.

Fig. 4 shows a combined power and light distributing board designed by the writer for a large chemical works, and built by the Walker Electric Company for about $1,100. It controls three 50-kilowatt Westinghouse alternators, 240-volt, sixty-cycle, three-phase, direct-connected to Harrisburg twelve-inch by eleven-inch side-crank engines, with three-kilowatt exciters coupled to the stub-end of the engine shafts. The voltmeters and ammeters on this board are all Westinghouse Type K, cheap, and amply accurate enough for such a voltage and reasonably deadbeat. The ammeters cost $12 and the voltmeters about $17. They operate by gravity, where a solenoid pulls down a small armature on the end of a brass rod against the counterweight on the needle shaft. Inside the solenoid, fits a test-tube full of non-freezing oil, in which the armature works, and the viscosity of this oil forms the deadbeat feature. In the Weston instruments, deadbeat working is obtained by an aluminum vane on the needle shaft, working in an enclosure just a little larger, so that the needle can go no faster than the air will allow it in passing over the edges of the vane. To adjust the Westinghouse meters there is a little rider which comes with each, and, when set correctly on the board, the rider should just bear the needle down to a red mark calibrated on the dial. At any future time the adjustment of the instrument can be tested by trying the rider. A caution to remember with these instruments is that they come packed with the working parts tightly bound up. There is nothing to indicate this in the instrument itself, and nothing is said about it except in the printed directions, which are usually purloined by the electricians doing the unpacking and never seen again. Any one, therefore, starting up without attending to these details is liable to have plenty of current and know nothing of it, until something goes up in smoke and is destroyed. Also, ring out everything with a magneto, especially the fine resistances for the voltmeters, which often come broken. It is always better to have the instruments showing something when there *is* current.

On the generator panels, besides the indispensable four instruments previously mentioned, there are two more ammeters, a synchroscope and an extra voltmeter on the swinging bracket. Where the lighting load is fully as heavy as the power, as in this case, one ammeter in each leg is preferable to show how much any big unbalancing in the lighting circuits is affecting the generators, but if at all pressed for funds, one ammeter will answer for all practical purposes. The synchroscope, costing $55, is entirely unnecessary in a board so small as this. None of them reads accurately enough to depend on in putting in the machines, compared to the synchronizing lamps, and its principal utility is in letting the oiler at the throttle know whether his engine is fast or slow, and in aiding him to get the speed right.

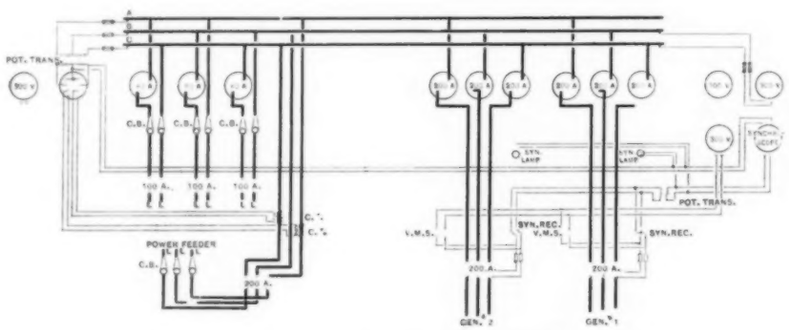


FIG. 4.—WIRING DIAGRAM OF THREE-PHASE BOARD.

The combined light and power panel needs little description. The power circuit goes right out from the end of the buses through switch and breaker. Branches to lighting circuits from buses pass through switches and breakers and out, one leg going through each of the ammeters at the top of the board. The writer has invariably found breakers more serviceable and reliable than fuses. They save many

accidents to the line and generators in thunderstorms, and the voltage drop around good makes is only ten millivolts, against 100 for the fuse, a saving in current which quickly pays for the breaker if the current has even two cents per kilowatt-hour sale value. Fig. 3 shows the wiring diagram of this board, and a study of the main and secondary connections will give one a fair insight into the standard connections for three-phase work, which are carried up to even the largest boards.

(To be continued.)

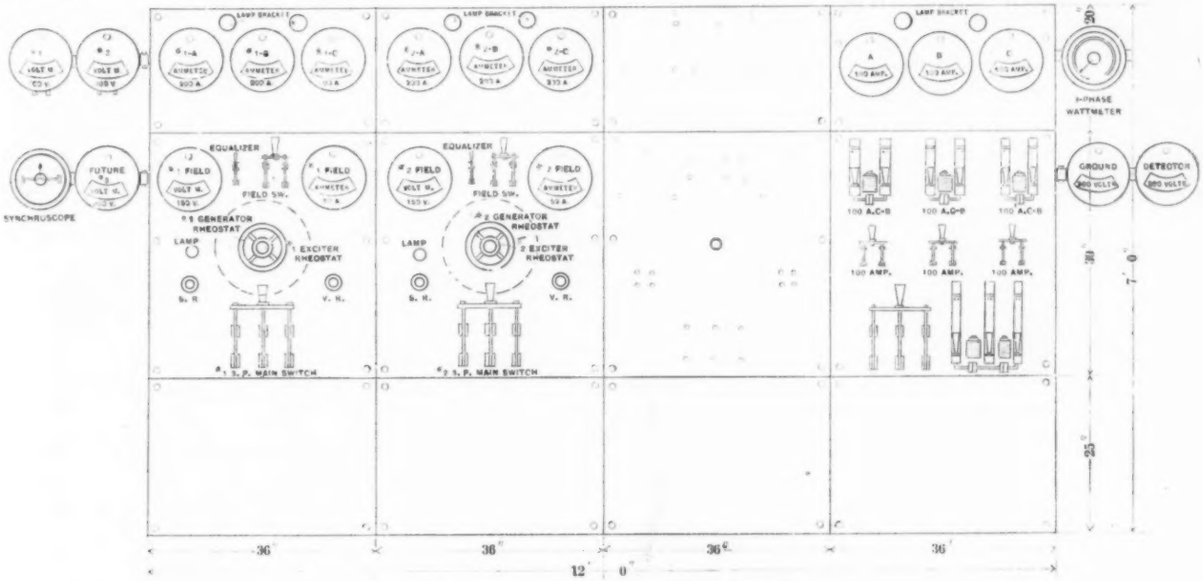


FIG. 4.—STANDARD THREE-PHASE BOARD.

Chicago's New City Hall to Use Hydroelectric Power.

The City of Chicago and the Sanitary District of Chicago have just concluded the arrangements for the supply of all electric power required in the new City Hall from the hydroelectric power station of the Sanitary District at Lockport, Ill. Duplicate underground mains will be installed by the Sanitary District from its terminal station at Thirty-first Street and Western Avenue to the City Hall, where it will install three motor-generator sets and auxiliary apparatus, such as transformers, oil switches and protective devices, to convert the three-phase supply to direct current at 230 volts for power service and 115 volts for lighting service. The motor-generators will be of such size that any two of them will be able to carry the peak load, the third being a spare unit. To insure continuity of supply, the Sanitary District will install a storage battery of sufficient capacity to carry the average load for six hours, the average peak load for two hours, and the maximum peak load for one hour. All this apparatus will be installed in the basement of the City Hall in a space not to exceed 4,000 square feet, and will be operated and maintained by the Sanitary District.

The city will pay one and one-fourth cents per kilowatt-hour for all electrical energy supplied to its lighting and power switchboard, and agrees to pay for a minimum of 600,000 kilowatt-hours per year. The connected load in the building will approximate 15,000 sixteen-candlepower lamps and 1,190 horsepower in motors. The contract holds for five years from the anticipated completion of the building, October 15, 1910. Provision is made for the monthly reading of meters, their testing, the rendering of bills, etc.

An almost identical contract has been concluded between the Sanitary District and Cook County for the supply of electrical energy for light and power service in the County Building in Chicago. This building is now supplied by the Commonwealth Edison Company under a contract which will expire January 1, 1911, when the Sanitary District service will begin. The County Building and City Hall occupy the entire block bounded by Washington, La Salle, Randolph and Clark streets, the County Building, which was completed in 1908, being the eastern half and the nearly finished City Hall the western half of an architecturally uniform and massive single structure devoted entirely to the public needs.

Rainbow Falls Power Development in Operation.

The first two units of 6,000 horsepower each of the Rainbow Falls Development at Great Falls, Mont., have recently been successfully started. According to Charles T. Main, of Boston, the engineer in charge of this work, the other four units of 6,000 horsepower each in this development will be in operation sometime in August.

The Rainbow Falls is the second largest of the five falls in the Missouri River at Great Falls, Mont., having a fall of fifty-four feet. There is an aggregate drop of 535 feet in the Missouri River within five miles, with a total possible development of about 350,000 horsepower.

Utilizing Iceland's Waterpowers.

It is reported that a Norwegian company has lately been formed to utilize the waterpower of the Gullfoss Falls, and part of that of the Sog Falls, both in Iceland.

English Municipal Electric Plant Shows Deficit.

The city of Bath, England, will have to pay a deficit of $2,900 out of its rates for the privilege of running its own electricity plant. This poor showing is for the year ended March 31.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Temperatures of Lamp Filaments.

A series of measurements of the temperatures of the metallic filaments of incandescent electric lamps has recently been made by M. v. Pirani at the lamp works of Siemens and Halske, and the results are given in part vii of the *Verhandlungen der Deutschen Physikalischen Gesellschaft*. The filaments were of platinum, tantalum, and tungsten. They were heated in an inert gas or *in vacuo* either by an external heating coil or by the current traversing them, and the temperature was measured by a standardized thermoelement of fine wire. Up to a temperature of 1,600 degrees centigrade it was found that temperature t and current i were connected by the relation $i = a + b.t^n$, where a and b are constants and n has a value between 1.5 and 2.5. This relation was used to determine the temperature above 1,600 degrees centigrade. Observations were also made of the black-body temperature of the filaments by a standardized radiation thermometer of the Holborn-Kurlbaum type, using red light. Tables are given of the resistances of the filaments up to temperatures just below the melting points, and it is shown that at these points the black-body temperatures are about 150 degrees centigrade below the actual temperatures.

Cheap Arc Lights in Cumberland.

Cumberland, Md., claims the distinction of operating its arc-lamp street-lighting system at a lower cost than any other city in the country. The recent annual report of the Water and Electric Light Commissioners states that the entire cost of operating its 317 arc lamps last year was $10,607.23, or $33.46 per lamp per year. The city paid $97 per lamp per year before the municipal plant was started. At the city's plant natural gas is used as fuel under the boilers. Whether the figures given included interest, maintenance and depreciation is not known.

DECORATIVE LIGHTING AT TERRE HAUTE, IND.

TUNGSTEN CLUSTERS ON CONCRETE COLUMNS.

The city of Terre Haute, Ind., boasts of one of the first installations of decorative lighting of business streets with tungsten-lamp clusters mounted on ornamental reinforced concrete columns. Concrete posts have been used considerably in boulevard and park lighting, but scarcely at all on business streets. The installation at Terre Haute, although not very extensive as yet, has shown not only the feasibility of using concrete columns for this purpose, but as well the highly ornamental effect attainable at a moderate cost.

TUNGSTEN CLUSTER AND CONCRETE COLUMN, TERRE HAUTE, IND.

At present the installation is confined to a portion of the downtown section of Wabash Avenue. The merchants organized and decided to pay on a frontage basis the entire cost of installing and operating the lamps. Arrangements were made with the local lighting company to supply the current. The lights are controlled by a time switch which automatically turns them on at sunset and off at eleven o'clock each evening. The current charge is on the flat-rate basis of $70 per year per column. The entire cost of installation was about $75 per column. The installation was completed in time for the G. A. R. encampment last May, at which time the photographs shown herewith were taken.

Each column supports five 100-watt tungsten lamps. The four downward hanging lamps are inclosed in ten-inch globes and the central upright lamp has a fourteen-inch globe. The columns are about fifty feet apart.

In the manufacture of the columns, which are of Doric design, waterproof granite concrete was used. The shaft portion is nine feet long, eleven inches in diameter at the base and nine inches at the neck. It rests on a base sixteen inches square with a four-inch plinth. Surmounting the Doric capital is a fourteen-inch abacus. On this rests the four-arm head seventeen inches in height. The spread of the arms is three feet from center to center of opposite lamps. To the center of the top globe the height is twelve feet.

Corrugated steel bars are used for reinforcing the arms as well as the main portion of the column. In addition to the bar reinforcing in the arms, there is placed in the center of the head a condulet box from which the iron

branch conduits extend through the concrete to the points where the holders are attached. From this condulet box a short conduit also extends to the holder for the top lamp.

In erecting the columns a sub-base of concrete was placed below the grade line through which the conduit carrying the wiring and the other reinforcing bars were brought up through the core of the column and joined with the reinforcing bars and conduit already placed in the head. After these connections were made and the cement mortar joints, by which the columns were set together, had thoroughly hardened, the central portion of the column was filled with thin concrete. When this had become set the entire column was in effect bound as one solid piece to the sub-base, thus making a very strong and rigid pillar. The columns were molded and erected by the Pettyjohn Company, of Terre Haute.

NIGHT VIEW OF TUNGSTEN-LAMP ILLUMINATION ALONG WABASH AVENUE, TERRE HAUTE, IND.

The merchants in front of whose establishments the new lights have been erected pride themselves as the most progressive in the city, because they have provided at their own expense a street-lighting system using the most modern lamps and columns of original design. The columns have the rich appearance of solid granite pillars and the effect is graceful and pleasing.

Police Signal Lights at Schenectady.

Schenectady, N. Y., boasts of a system of electric call lights for the police. Although now confined to the downtown district, it will be extended to comprise about 100 lights. These are controlled by switches in the sergeant's office at police headquarters and are so arranged that any or every officer on patrol duty can be called to a telephone or the police call box within a few seconds by the flashing of the lights.

Lighting at Mexican Centennial Celebration.

The electrical illumination of Mexico City during the month of September in honor of the centennial celebration of Mexico's independence will be on a much more elaborate scale than was originally contemplated by the committee having the arrangements in charge. It is now estimated by the Mexico Light and Power Company that nearly three hundred thousand additional incandescent electric lights will be burned during the entire month.

The great Catholic Cathedral edifice will be a blaze of light from basement to dome, the plans for its illumination calling for the stringing of sixteen thousand incandescent lamps. More than eight thousand lamps will be used to decorate the front of the National Palace. On each of the other public buildings from 2,000 to 6,000 lamps will be used. Every business house in the city has made arrangements for the elaborate decoration of its exterior with electric lights, some of them contracting for as many as 8,000 of the lamps.

It is announced by the committee on arrangements that it has carefully worked out the street scheme of illumination. The downtown business district will be canopied with light. Many triumphal arches will be erected at various street intersections. The main arch of independence will be located at the intersection of Plateros street and the Zocola plaza upon which front the Cathedral and National Palace. It will contain 600 incandescent lamps of ten candlepower each and twenty twelve-ampere arcs. At the intersection of each cross street on Avenida San Francisco and Avenida Juarez a doube arch each containing 140 lamps will be erected. These arches will cross each other, and will consist of two stringers of seventy lamps each. In the middle of the block two additional arches will be placed so that in each block there will be stretched six arches.

Many novel electrical decorative schemes for business blocks and private residences have been evolved. A display of the Mexican colors in the decorations will form a part of the decorative scheme for all the streets and buildings. D.

German Activity in Exporting Incandescent Lamps.

There is food for thought for American lamp manufacturers in the report of United States Consul-General Richard Guenther, of Frankfort, Germany, respecting the rapid growth of the German exportation of incandescent lamps. In the year 1901 Mr. Guenther says it amounted in value to $664,000; in 1907 to $2,000,000; in 1908, $4,780,000; and in 1909, $7,856,000. The exportation during the first quarter of 1910 was valued at $3,775,000, against $1,737,000 for the corresponding three months of 1909. This increase is due to enlarged shipments to Great Britain, Austria-Hungary, Argentina, Russia, Denmark, and Italy.

At Racine, Wis., a large number of merchants and property owners have agreed to pay part of the cost of ornamental lighting, Corinthian columns to be installed. A number of lights will be placed on Wisconsin Street to prove an incentive to the movement.

STREET LIGHTING IN CHICAGO.

DISCUSSED BY THE ELECTRIC CLUB.

The regular weekly meeting of the Chicago Electric Club, held on July 13, was devoted to a discussion of the new extension to the electric street-lighting system of Chicago.

William Carroll, city electrician, stated that the city is now supplied with electrical energy from the Western Avenue terminal station of the Sanitary District of Chicago for the lighting of 12,000 street arc lamps. These lights are in service on the average about eleven hours each night. About 11,000 horsepower is now supplied for this purpose at $15 per horsepower per year. The Sanitary District now has available surplus energy sufficient to supply 10,000 additional arc lamps. On account of the poor financial status of the city, however, it was unable to install these additional lamps and the necessary lines therefor. The Sanitary District has consequently come to the relief of the city by offering to take over the city's present lines and substations, build additional lines and substations, install 10,000 additional arc lamps or their equivalent, supply the current to the substations and operate them. While this agreement has not yet been concluded, it will doubtless be ratified on substantially those terms. The installation is to be completed in three years and the original cost of the additions will be repaid by the city within seven years. The city is to pay for the energy supplied to the lighting circuits at the rate of $15 per year for each horsepower of maximum demand and $1 per year per arc lamp or equivalent for the operation of the substations; the city will trim and maintain the lamps, however. By this extension of the electric street lighting system the city will save at least $27,000 per year and have the use of the Sanitary District's lines. The latter will have the use of the city's unused lines. The additional equipment will give a total of 22,000 arc lamps in street-lighting service. It is estimated that 30,000 arc lamps would be required to light all of the city streets along the lines now followed. The city has an area of 190 square miles and, as much of its outlying portion is still vacant, no attempt will be made now to light all of the streets electrically. The new agreement does not specify that arc lamps must be used, and it is probable that tungsten and other electric lamps will be installed in certain sections. No attempt at decorative or spectacular lighting will be made with the moderate funds available, with the exception of the square about the County Building and new City Hall, which will be illuminated in a model manner.

F. J. Postel suggested making the new street lighting a first-class installation in every way as it will be in service at least ten years. The engineers should consider they are putting in a permanent plant. The lighting requirements in different parts of the city are not alike. Arc lighting such as in downtown and business streets is not suitable for residence streets with numerous trees. For this the series tungsten system with underground ducts is probably much more suitable. If it is necessary to put up any overhead lines, they should be in alleys. The "city beautiful" idea should be adhered to, also the highest engineering ideals. Therefore, it would be better to put in fewer lamps well than many poorly.

Mr. Carroll replied that it would cost at least four times as much to put the distributing lines underground as to put them overhead. The greatest demand for electric street lighting comes from streets where trees do not abound and the residents are content to have the lines placed overhead in order to insure getting the electric lights quickly. The extensions have been laid out in districts to contain 1,500 lamps with a substation in the center. The high-voltage lines to the substations will be underground, but most of the lighting circuits will be overhead. Mr. Carroll is highly in favor of exclusive underground service, but in order to do the most good in the shortest time he thinks overhead distribution will not be found objectionable till more funds are available to place the wires underground gradually as street improvements are made.

W. A. Jackson said the financial question is always an important one in any new project, it being desirable to get the greatest good with the funds available. The steel poles, with only one or two wires, already put up by the city, have not proved unsightly; in fact, they are quite inconspicuous.

W. B. Jackson declared that conditions differ quite considerably in different parts of the city. Certain streets essentially require underground conduits, while others can be served as well by overhead lines.

J. G. Pomeroy believed it would be a mistake to install lamps that would be a back number in about five years. He therefore urged the practicability of using flame arcs, both of the metallic and impregnated carbon types, for business streets and tungstens for residence streets.

J. H. Delaney called attention to the lighting of business streets with ornamental tungsten clusters along the curb-line. About a thousand of such posts have been installed in Chicago, for which the charge to the merchants is $1.50 per week, the lamps and posts being installed, illuminated and maintained by the central-station company.

Others who discussed the subject briefly were W. R. Bonham, H. B. Gear and Geo. H. Porter. It was decided to ask the club's civic committee, composed of P. B. Woodworth, W. L. Abbott, James Lyman, Geo. H. Lukes, K. B. Miller, E. A. Rummler and K. P. Gaylor, to take up the matter with the proper authorities and to suggest to them the club's ideas on making Chicago's electrical street lighting both comprehensive and thoroughly up-to-date.

During the meeting, which was presided over by Fred. P. Vose in his usually congenial manner, J. H. Delaney was appointed chairman of the reception committee and Geo. H. Porter, of the entertainment committee, reported plans for the club's annual picnic to be held in August.

Ornamental Street Lighting Projects Advance.

At Moorhead, N. D., there has been completed an installation of seventy ornamental posts, each carrying a cluster of five tungsten lamps, four on brackets and one on top.

At Duluth, Minn., the Great Northern Power Company has placed three ornamental five-light posts in front of its substation at Fifteenth Avenue and Superior Street, with the idea of popularizing ornamental lighting in the West End of the city where there has been some talk of installing a "white way."

TELEGRAPHY—TELEPHONY, and WIRELESS.

The Government's Telephone Service in London, England.

A correspondent of the London *Times* writes as follows, comparing the telephone service of that city with that of New York:

"Among the many annoyances which we have to put up with in the Post Office service, we might mention the following: (1) Interruption by a third party during a conversation; (2) absolute disconnection in the middle of a conversation; (3) connection with the wrong number; (4) indistinctness of conversations owing to faulty lines.

"There are many other annoyances which it would take too much of your valuable space to enumerate.

"We do not think that the above experience is exceptional, and are sure that most business men have experienced the same annoyance. No amount of complaints to the Post Office seem to have any effect, and, as we have frequently informed them, the service is getting worse instead of better. When it is pointed out to the telephone authorities how much better the service is in, say, New York, all they can reply is that people in New York pay more for their service, as if this is any justification for giving us a bad service. Surely, sir, most business men would be willing to pay more if they could get a service in London equal to that which they have in New York! A bad telephone service is dear at any price."

Subway Telephone Installations Started in Chicago.

President Harris, of the Subway Telephone Construction Company, says the installation of the automatic telephones has begun and that 20,000 telephones will be in operation by October 1.

Since the company announced that the work of installing these telephones would be pushed it has carried display advertisements in the daily papers with a view of popularizing the automatic service.

Wireless in the Far East.

Consul-General James T. DuBois writes from Singapore that wireless telegraphy is coming slowly but surely to the Far East. Soon the Peninsular and Oriental Company will have at least fifteen of its vessels equipped with wireless apparatus, and the China Mail steamers will follow suit. The Germany Lloyd is preparing to equip its Imperial East Asiatic Line. The fitting up of shore stations is now the most serious problem. Last November the Princess Alice, of the German Lloyd, was caught in a terrific typhoon on its way from Hongkong to Singapore. It was equipped with wireless, but the force of wave and wind had disabled its sending capacity, and while it was in constant receipt of messages from the British cruiser Kent, then anchored in Singapore Bay, it was unable to reply, and this caused intense anxiety until the Princess Alice reached harbor three days overdue.

Navy Wireless Stations.

The Navy Department has decided to erect four wireless-telegraph towers on the highest point available in the District of Columbia. This decision was made between these four towers and one very high tower which, it was suggested, might be erected in Washington.

Permission was asked of the War Department to erect such towers in the grounds of the National Soldiers' Home which has an elevation of about 250 feet above the spot on which the Washington monument stands. The towers will be of steel of light and graceful design and may be copied after the wireless masts on the big battleships.

The purpose of the towers will be to afford the Navy Department the best opportunity possible for communicating without interruption with its ships far out at sea, and with the land stations far removed. Tests recently made by the Navy Department lead to the belief that communication with ships in the daytime 1,500 miles away and at night 3,000 miles distant will be possible.

Telephone Suit in Nebraska.

Suit has been filed in the Supreme Court by Attorney General Thompson, against the American Telephone and Telegraph Company and the Nebraska Telephone Company. It is alleged that the companies have violated the anti-trust laws of the state. A temporary injunction was asked for, to prevent the merger of rival companies, and this was issued by the court.

Attorney General Thompson also asked that the combination be dissolved and the company be ousted from the state of Nebraska.

To Enforce Wireless Law.

In order that the Bureau of Navigation may be correctly informed as to the enforcement of the law requiring steamers to carry wireless equipment, the collectors of customs have been directed to furnish a list of all vessels to which the act is applicable. The statement of vessels is required to give the name of the system of equipment, whether the equipment is owned by the steamer or leased, the wave length in meters, the range in nautical miles, the power in kilowatts, and the call letters.

It is estimated at the Bureau of Navigation that about sixty per cent of all steamers subject to the provisions of the act are probably equipped already with the apparatus required, thus leaving some forty per cent still to be provided.

Successful experiments were made recently in an English chalk-pit of considerable depth with a new wireless telegraphic and telephonic apparatus to enable miners to communicate with the pit-head. Experiments will shortly be made with the same appliances in the Rhondda Valley, Wales.

The History of the Telephone.

The Development of the Telephone Exchange—I.

BY HERBERT N. CASSON.

The crowning glory of a telephone system of today is not so much the simple telephone itself, nor the maze and mileage of its cables, but rather the wonderful mechanism of the switchboard. This is the part that will always remain mysterious to the public. It is seldom seen, and it remains as great a mystery to those who have seen it as to those who have not. Explanations of it are futile. As well might anyone expect to learn Sanscrit in half an hour as to understand a switchboard by making a tour of investigation around it. It is not like anything else that either man or nature has ever made. It defies all metaphors and comparisons. It cannot be shown by photography, not even in moving-pictures, because so much of it is concealed inside its wooden body. And few people, if any, are initiated into its inner mysteries except those who belong to its own cortege of inventors and attendants.

A telephone switchboard is a pyramid of inventions. If it is full-grown, it may have two million parts. It may be lit with 15,000 tiny electric lamps and nerved with as much wire as would reach from New York to Berlin. It may cost as much as a thousand pianos or as much as three square miles of farms in Indiana. The 10,000 wire hairs of its head are not only numbered, but enswathed in silk, and combed out in so marvelous a way that any one of them can in a flash be linked to any other. Such hair-dressing! Such puffs and braids and ringlet relays! Whoever would learn the utmost that may be done with copper hairs of Titian red, must study the fantastic coiffure of the telephone switchboard.

If there were no switchboard, there would still be telephones, but not a telephone system. To connect 5,000 people by telephone requires 5,000 wires when the wires run to a switchboard, but without a switchboard there would have to be 12,497,500 wires—4,999 to every telephone. As well might there be a nerve-system without a brain as a telephone system without a switchboard. If there had been at first two separate companies, one owning the telephone and the other the switchboard, neither could have done the business.

Several years before the telephone was given a switchboard of its own, it made use of the boards that had been designed for the telegraph. These were as simple as wheelbarrows, and became absurdly inadequate as soon as the telephone business began to grow. Then there came adaptations by the dozen. Every telephone manager became by compulsion an inventor. There was no source of information and each exchange did the best it could. Hundreds of patents were taken out. And by 1884 there had come to be a fairly definite idea of what a telephone switchboard ought to be.

The one man who did most to create the switchboard—who has been its devotee for more than thirty years, is a certain modest and little known inventor, still alive and busy, named Charles E. Scribner. Of the 9,000 switchboard patents, Scribner holds 600 or more. Ever since 1878, when he devised the first "jack-knife switch," Scribner has been the wizard of the switchboard. It was he who saw most clearly its requirements. Hundreds of others have helped, but Scribner was the one man who persevered, who never asked for an easier job, and who in the end became the master of his craft.

It may go far to explain the peculiar genius of Scribner to say that he was born in 1858, in the year of the laying of the first Atlantic cable; and that his mother was at the time profoundly interested in the work and anxious for its success. His father was a judge, in Toledo; but young Scribner showed no aptitude for the tangles of the law. He preferred the tangles of wire, and as a boy his favorite playtoy was a telegraph system in miniature, which he and several other boys had built and learned to operate. These boys had a benefactor in an old bachelor named Thomas Bond. He had no special interest in telegraphy. He was a dealer in hides. But he was attracted by the cleverness of the boys and gave them money to buy more wires and batteries. One day he noticed an invention of young Scribner's—a telegraph repeater.

"This may make your fortune," he said, "but no mechanic in Toledo can make a proper model of it for you. You must go to Chicago, where telegraphic apparatus is made." The boy gladly took his advice and went to the Western Electric factory in Chicago. Here he accidentally met Enos M. Barton, the head of the factory. Barton noted that the boy was a genius and offered him a job, which he accepted and has held ever since. Such is the story of the entrance of Charles E. Scribner into the telephone business, where he has been well nigh indispensable.

C. E. SCRIBNER.

His monumental work has been the development of the multiple switchboard — a much more brain-twisting problem than the building of the Pyramids or the digging of the Panama Canal. The earlier types of switchboard had become too cumbersome by 1885. They were well enough for five hundred wires, but not for five thousand. In some exchanges as many as half a dozen operators were necessary to handle a single call; and the clamor and confusion were becoming unbearable. Some handier and quieter way had to be devised, and thus arose the multiple board. The first crude idea of such a way had sprung to life in the brain of a Chicago man named L. B. Firman, in 1879; but he became a farmer and forsook his invention in its infancy.

In this multiple board, as it grew up under the hands of Scribner, the outgoing wires are duplicated so as to

be within reach of every operator. A local call can thus be answered at once by the operator who receives it; and any operator who is overwhelmed by a sudden rush of business can be helped by her companions. Every wire that came into the board was tasseled out into many ends, and by means of a "busy test," invented by Scribner, only one of these ends could be put into use at a time. The normal limit of such a board is 10,000 wires, and will always remain so, unless a race of long-armed giantesses should appear, who could be able to reach over a greater expanse of board. At present, a business of more than 10,000 lines means a second exchange.

The multiple board was enormously expensive. It grew more and more elaborate until it cost one third of a million dollars. The telephone men racked their brains to produce something cheaper to take its place, and they failed. The multiple boards swallowed up capital as a desert swallows water, but—they saved ten seconds on every call. This was an unanswerable argument in their favor, and by 1887 twenty-one of them were in use. Since then the switchboard has had three or four rebuildings. There has seemed to be no limit to the demands of the public or the fertility of Scribner's brain. Persistent changes were made in the system of signaling. The first signal, used by Bell and Watson, was a tap on the diaphragm with the finger-nail. Soon afterwards came a "buzzer," and then the magneto bell. In 1887 Joseph O'Connell, of Chicago, conceived of the use of tiny electric lights as signals—a brilliant idea, as an electric light makes no noise and can be seen either by night or by day. In 1901 J. J. Carty invented the "bridging bell," a way to put four houses on a single wire, with a different signal for each house. This idea made the "party line" practical and at once created a boom in the use of the telephone by enterprising farmers.

In 1896 there came a most revolutionary change in switchboards. All things were made new. Instead of individual batteries, one at each telephone, a large common battery was installed in the exchange itself. This made better signaling and better talking. Best of all, it saved four seconds on every call. Since then there have come some switchboards that are wholly automatic. Few of these have been put into use, for the reason that a switchboard, like a human body, must be semi-automatic only. To give the most efficient service, it will always need an expert operator to stand between it and the public.

As the final result of all these varying changes in switchboards and signals and batteries, there grew up the telephone exchange. This is the solar plexus of the telephone body. It is the home of the switchboard. It is the vital spot. It is not anyone's invention, as the telephone was. It is a growing mechanism that is not yet finished, and may never be; but it has already evolved far enough to be one of the wonders of the electrical world. There is probably no other part of an American city's equipment that is as sensitive and efficient as a telephone exchange.

The idea of the exchange is somewhat older than the idea of the telephone itself. There were communication exchanges before the invention of the telephone. Thomas B. Doolittle had one in Bridgeport, using telegraph instruments. Thomas David had one in Pittsburg, using printing-telegraph machines, which required little skill to operate. And William A. Childs had a third, for lawyers only, in New York, which used dials at first and afterwards printing machines. These little exchanges had set out to do the work that is done today by the telephone, and they did it after a fashion, in a most crude and expensive way. They helped to prepare the way for the telephone, by building up small constituencies that were ready for the telephone when it arrived.

Bell himself was perhaps the first to see the future of the exchange. In a letter written to some English capitalists in 1878, he said: "It is possible to connect every man's house, office or factory with a central station, so as to give him direct communication with his neighbors. . . . It is conceivable that cables of telephone wires could be laid under ground, or suspended overhead, connecting by branch wires with private dwellings, shops, etc., and uniting them through the main cable with a central office." This remarkable prophecy has now become stale reading—as stale as Darwin's "Origin of Species," or Adam Smith's "Wealth of Nations." But at the time it was a most fanciful dream.

[EDITOR'S NOTE.—This is the third part of a series of telephone articles by Mr. Casson on the History of the Telephone. Chapter II of "The Development of the Telephone Exchange" will be followed by articles on "The Telephone in Foreign Countries," and "Litigation Over the Telephone," each in two parts.]

New Telephone Building for Boston.

The New England Telephone and Telegraph Company has, due to the greatly increased number of its employes, found it necessary to construct a large telephone exchange. This building, which will occupy an entire square bounded by Oliver, High, Batterymarch and Wendell streets, will have an average length of 135 feet, an average width of ninety-five feet, and will cover a ground area of over 12,000 square feet. The total floor space, exclusive of hallways, elevators, etc., will be approximately 88,000 square feet.

About nine hundred employees will move into the building, which has been designed to accommodate about twelve hundred ultimately. At present these employes are located in a number of buildings. Several hundred others employed in the seven metropolitan exchanges and a number of clerks and workmen will continue in present locations.

While the building has been designed primarily for office work certain floors will be constructed with regard to height and strength so as to permit the installation of exchange equipment if it is found desirable in the future to install it.

There will be four electric elevators of the latest model, direct traction type, combining maximum of safety and efficiency of operation. The building will be equipped with a mechanical ventilating system. The lighting will be universal ceiling illumination.

English Wireless Bill.

Sir Edward Sassoon's bill making compulsory the equipment of all passenger vessels with a wireless system passed the first reading in the House of Commons recently. It provides that all ships, both British and foreign, which embark with passengers at British ports must be provided with an installation capable of receiving and transmitting a distance of one hundred miles. A penalty of $5,000 in the event of a failure to obey the law is provided.

American Telephone Experts to Attend International Conference in Europe.

John J. Carty, chief engineer of the American Telephone and Telegraph Company, and C. E. Scribner, chief engineer of the Western Electric Company, will represent the United States at the international conference of telegraph and telephone interests in Paris next September, in response to an invitation from the representatives of the French government for American participation in this important convention. Among the topics to be discussed at the conference are the standardization of telephone equipment and the relative merits of automatic, semi-automatic and manual systems.

Important Telephone Merger.

At the time of going to press it has been announced that the Michigan State Telephone Company has been absorbed by the American Telephone and Telegraph Company.

The financial sponsor of the Michigan organization, the Harris Trust and Savings Bank, is reported to have made the official announcement, and it is said that negotiations for the delivery of the majority of the stock of the Michigan concern had been on for some time.

The absorption of the Michigan company makes the thirty-first telephone company now controlled by the American Telephone and Telegraph, which also includes the Chicago Telephone Company, the Central Union Telephone, and practically all of the systems in the eastern cities.

The holders of the majority of the Michigan State Telephone common stock, represented by the Harris Trust and Savings Bank, will exchange their holdings for the shares of the American Telephone and Telegraph on the basis of five shares of Michigan State for four shares of the American Telephone. The minority have the same privilege of exchange on the same basis as the majority.

There are outstanding $6,000,000 of ordinary shares and $2,285,300 of the preferred and over $9,000,000 of bonds.

Chinese Telephone Exchange.

The development of Chinese telephone business has been brought to the highest degree in San Francisco, where a new Chinese exchange was opened recently by the Pacific Telephone and Telegraph Company. There is no question that had it not been for the efforts of this company in educating the Chinese in the use of the instruments this productive field in San Francisco would have gone to waste.

The new exchange can take care of 3,500 subscribers. The manager is a Chinaman, the chief operator is a Chinaman, and the operators are Chinese girls. There are also three Chinese boys employed on the switchboard.

All the operators can speak English. When a call comes in they answer "Hello" in English. The party calling then asks for the party he wishes as, "Give me Moy Sing" or "John Hop Wo." The operators are trained so that they know the names of every Chinese subscriber, and a number is not required.

Telephones in the Antarctic.

Members of the staff of the National Telephone Company, of England, have presented to Captain Scott a special telephone installation designed to enable him to keep in touch with his ship on his coming Antarctic expedition, up to a distance of twenty-six miles. The instruments are suited for work in extremely low temperatures. No transmission poles will be needed, the wires being merely laid a short distance apart on the ice or snow, which is a nonconductor.

New Patent Law in Holland.

The *English Mechanic and World of Science*, on the authority of W. P. Thompson and Company, of Liverpool, England, states that a new patent law for the Netherlands has been passed by the Second Chamber of the States General, and is almost certain to be adopted by the First Chamber within the year. Among the clauses there is one for the granting of compulsory licenses at the end of three years for patents which have not been worked by the inventors in the kingdom, and another requiring compulsory working either by the patentee or his licensee within five years from the date of grant of the patent.

Wireless in the Far East.

Consul General James T. DuBois writes from Singapore that wireless telegraphy is coming slowly but surely to the Far East. Soon the Peninsular & Oriental Company will have at least fifteen of its vessels equipped with wireless apparatus, and the China Mail steamers will follow suit. The North German Lloyd is preparing to equip its Imperial East Asiatic Line. The fitting up of shore stations is now the most serious problem.

Montefiore Prize for Applications of Electricity.

The council of the Association des Ingénieurs électriciens sortis de l'Institut électrotechnique Montefiore, Liége, has issued the conditions which will govern the triennial award of the prize—the "Fondation George Montefiore"—which is to be awarded for the first time in 1911. The prize will be the accumulated interest on 150,000 francs in Belgian three per cent funds, and is to be given for the best original work in French or English on the scientific advance and the progress in the technical applications of electricity. The last date for the reception of works to be submitted to the committee of award is March 31, 1911. Competitors should address M. le Secrétaire-archiviste de la Fondation George Montefiore, à l'Hôtel de l'Association, rue St. Gilles, 31, Liége.

Telephone Franchise Provides for Underground Wires.

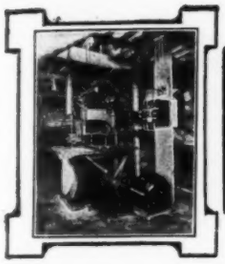
According to the *Municipal Journal and Engineer*, the Board of City Councilmen, of Dayton, Ohio, meeting as a committee of the whole, agreed upon a telephone franchise ordinance drawn up by City Attorney Hubbard Schwartz. The ordinance provides for the sale of a telephone franchise to the highest bidder. It also provides that the successful bidder must lay at least 3,000 feet of its wires under ground the first year and 5,000 each year thereafter.

Electrical Trade Purchases by Argentina.

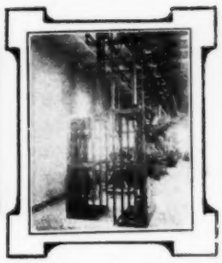
Argentina's purchases of electrical goods, according to a recent report of the Belgian legation in Buenos Aires, in percentages are from the following leading countries: Germany, 49.1; United Kingdom, 31.2; United States, 9.8; France, 3.6; Italy, 3.3; Belgium, 1.4.

June Exports of Copper.

The Metal Exchange report total exports of copper for June 23,430 tons, compared with 33,774 tons last year.



Industrial Power



APPARATUS FOR WARPING, WINDING, HOISTING, ETC., ON BOARD SHIP.[1]

BY JAS. A. LIDDLE.

In regard to ship auxiliary machinery, there are at least four different efficiencies to be considered. There is the mechanical efficiency of the machine in question. This is the first important point for land work, but in marine work the mechanical efficiency is of no importance if the machine does not possess other high efficiencies, such as weight divided by power and volume divided by power; reliability, first cost, together with annual expenditure, interest, sinking fund, upkeep, and insurance. All these and possibly several other efficiencies or properties have to be linked together. Even if a piece of auxiliary machinery, having to the highest degree all the before enumerated properties, were procurable, superintendent engineers and shipowners would have great difficulties to overcome before introducing these on board ship, because the majority of sea-going engineers have only a knowledge of the steam engine and its characteristic properties. If given an internal-combustion engine or an electrical motor, they would subject it to the same working treatment as they would a steam engine. I hold that the designer of internal-combustion engines and electrical machinery must meet superintendent engineers and shipowners half way.

In the design of electric motors for marine work, these are two very important quantities to be fixed, because if there is no limit to speed and no limit to temperature rise we may design marine motors as small and as light as we please. Taking temperature rise first: the size and weight must be controlled by the class of insulating material at our disposal, but for present day practice no part of a motor should be allowed to heat above ninety degrees centigrade. Now what determines the motor speed? The rotating agents present in an electric motor are lines of magnetic force acting at right angles to electric current. As neither of these has any wearing-out effect upon the materials through which they pass, we lose nothing and gain everything by increasing the speed of the motor. However, as no person has yet been able to invent a means whereby two elements may rotate relative to each other without bearing or friction, our motor speed becomes limited from bearing friction. Then in continuous-current motors we have the brushes and commutator. Experiment has determined that to give good commutation the commutator speed must lie between 2,000 feet per minute and 3,000 feet, and nearer 3,000 feet than 2,000 feet. Thus, if we want high spindle speed the diameter of the commutator must be small, and above certain speeds it becomes impossible to construct the commutator to give satisfaction. With speeds up to about 2,000 revolutions per minute on sizes up to, say fifty horsepower, there is nothing in commutator or bearing design to prevent good results. In alternating and continuous-current motors we have to reckon with centrifugal force, but the main factor in determining the speed is the transmitting agent which connects and links up our speed spindle to the machine to be driven. It is here we are brought face to face with the problem which, if solved, will save seventy-five per cent to 100 per cent, compared to the present methods of working auxiliary machinery. There is a general impression abroad among builders of winches, capstans, hoists, etc., that slow-speed motors are essential. Certainly, if resistances or controllers are used to regulate or adjust the speed, slow speed is essential, because a continuous-current motor which has its speed varied must have a variable commutator speed, and no design can allow of great variation of commutator speed without injurious sparking at the brushes. Therefore, motors used in conjunction with controllers must be of slow speed, and even then the commutation and sparking cannot be entirely avoided. Further, the use of resistances or controllers for regulating the speed entails a waste of energy, and every motor fitted with a controller must be considerably larger and heavier than one without.

For many reasons I would not use any means of controlling the motor speed. What I would propose for continuous current is a compound-wound motor fitted with commutating poles. The motor would, of course, be designed for constant speed. Such a motor can be made to run absolutely without sparking on any load and under any variation of load, no matter how sudden. I have had a motor as described running at 1,700 revolutions per minute, doing regular work for seven months without having the commutator or brushes looked to. The motor in question works on a variable load, and is very often severely overloaded. With high-speed continuous-current motors properly designed, commutator and brushes have no particular drawback.

Squirrel-cage, three-phase, alternating-current, high-speed motors meet my ideal design for use with capstans, winches, etc., on board ship. With the system I propose the three-phase squirrel-cage motor would require absolutely no attention from the ship's engineers. The only examination it would require would be at the time of the ship's annual overhaul. Whether the system adopted be continuous or alternating current, I would not make use of any electrical speed control on the motors, because, when an electrical speed control is brought to act upon a motor, the size and weight of the motor must be considerably increased, and again, high-speed motors do not lend themselves to speed control. My de-

1 Abstract of a paper read before the (British) Institute of Marine Engineers, March 21, 1910.

sign so far has been to get rid of superfluous weight and volume, and if I bring in electrical speed control I immediately lose what I have tried to gain. Considering the present electrical qualification of sea-going men, supplying an electrical motor with a variable speed control means that the motor will in all probability be standing at the moment when it is most required. All electrical contact systems, hot wires, etc., have a certain amount of unreliability about them, especially if used in various climates. I find even men on shore, who have far more opportunities of learning how to detect electrical faults than men at sea can have, will blame the motor for being burnt out or the like, when the fault may only mean a broken wire in the controller, which could be repaired in an instant if the man had the ability to find it. Thus there are six distinct gains to be effected by the use of high-speed motors without electrical speed control: (1) the weight divided by the power gives high efficiency; (2) the volume divided by the power gives high efficiency; (3) the power turned out divided by the power put in gives high efficiency; (4) reliability; (5) small cost of upkeep; (6) low first cost.

With continuous-current motors of all sizes above, say, a quarter horsepower and alternating-current squirrel-cage motors above, say, five horsepower, some form of starter must be used to check the current until the rotating part of the motor gets up sufficient speed to protect itself. Wire starters have some of the drawbacks shown in wire controllers, and we are again faced with the difficulty of unskilled operators, therefore, I propose dispensing with the ordinary motor starter, which is generally constructed of wires and sliding copper contacts. In ship work the resistance wires when heated quickly oxidize and crumble away, and are a source of constant trouble. The sliding copper contacts, when used with insufficient care, become burred and burnt at the corners, and thus tend to stick. When left idle for some time they become encrusted with verdigris, which prevents good contact. I dispense with sliding contacts altogether; in fact, I do away with every movable electrical part in the starter, so that the electrical conditions remain always unaltered, and require absolutely no attention. I make the resistance of the simplest possible construction, so simple in fact that it can be renewed at any part of the world if need be, without costing anything. The resistance I use is fresh water with soda or oxide of sodium. If fresh water and soda cannot be obtained for this purpose, sea water without the added soda may be used.

The only electrical point requiring consideration is the switch for starting or stopping the motors. The mechanical action of this switch should be such that its blades have no intermediate position between full on and full off, or full off and full on, or, in other words, it must be impossible for the operator to hold the switch in any mid-position. This switch can be arranged to work mechanically by means of lever, pedal, wheel, key, or any other desired method. So far as the electric motor is concerned, everything is automatic and is quite independent of the person acting as operator.

Before leaving the high-speed electrical motor there is a point worth drawing attention to, viz., vertical spindle motors. With these, even though the ship has a considerable list, the working conditions remain unchanged, and all out-of-balance forces such as gravity effects are eliminated. Within the past few years several prominent motor builders made use of ball bearings on motors. On horizontal motors these proved failures, and the motor builders were obliged to go back to the old type of bearing. With vertical spindle motors ball bearings have proved a perfect success, and can be run for twenlve months on one lubrication. In ship work there are numerous advantages to be gained by the use of vertical spindle motors.

I must now come to the question of gearing or linking up of the high and constant-speed motor to capstans, winches, and other ship auxiliaries. Belting is suitable for fairly high speeds, but is quite out of the question in ship work. I might consider worm or skew gearing. These gears have practically reached their zenith of perfection, but the improvements which have been made in worm gears have been reached more through practical experience and tests than through theoretical calculations. In fact, from theoretical calculation it is impossible to design a worm and worm wheel with a bearing surface contact greater than the theoretical plane, and that only for one tooth. To me the worm and worm wheel have a resemblance to Cook and Peary. There is a certain amount of doubt as to the pole which was reached. With the worm and worm wheel there is always a certain amount of doubt as to the tooth surface in bearing contact.

The useful purpose of a worm gear is generally with very light loads if the speed is fairly high. If the load is to be heavy, the speed must be very, very slow, and if the efficiency is to be above fifty per cent, the reducing factor must be small. From this it will be seen that I must either discard my high-speed motors or the worm gear.

Considering ordinary gears, we have several different styles and types to select from, viz., rawhide, fiber, paper, bronze, cast iron, cast steel, forged steel, etc. Then there are the types of teeth, such as plain, helical, double helical, of involute, cycloidal, or other form. I do not think there is any place in which we could gain more information regarding wheel teeth than at a motor garage where old motor cars of every description are repaired. Within the past dozen years a new class of engineering has sprung up. It has, doubtless, many lessons to learn from the older system, but the older system has doubtless some lesson to learn from the new. I must say that I was completely beaten regarding successful gearing of the high-speed motor until I considered all types of motor-car gears. Having now selected a forged steel, machine cut, case hardened, short-toothed gear, I can settle the maximum speed of my electric motor. With ordinary teeth these gears may have a velocity of 6,000 feet per minute. From this it will be seen that the continuous-current motor speed is settled by the commutator, and the alternating-current motor speed cannot be much in excess of that of the continuous. Therefore I select speeds of 1,700 to 2,000 up to five horsepower, 1,000 to 1,500 from five horsepower to twenty horsepower, etc. A 2,000-revolutions-per-minute motor could be fitted with a pinion one foot in diameter without exceeding the speed limit. On a motor of 2,000 revolutions per minute, however, I do not require a pinion of more than three inches or four inches diameter, thus the tooth velocity is only one-third or one-quarter the permissible velocity. Further, these gears are

at least twelve times stronger than similar gears in cast iron. In other words, a forged steel pinion having machine-cut, case-hardened teeth 1 inch wide will do work which would break a cast-iron pinion 12 inches in width.

The next point is the arrangement of these gears in such a manner to gain the greatest advantages. I again consulted motor-car gear and gear-box design, but failed to find exactly what I wanted. I found numerous examples, however, the worm parts of which showed me what to refrain from doing. In avoiding these defects of design I was led into a form of gear which has given me surprising results, results of which I had not the slightest thought when I designed the gear. Some of these are of vast importance in conjunction with any geared electric motor. Every electric motor when overloaded, or, in other words, when working under crane-rated conditions, loses in efficiency on increase of load. If the motor is geared to the capstan, winch, etc., by means of gear which also falls in efficiency when the load is increased, the combined efficiency must necessarily be poor, and as the load increases the current consumption will increase out of all proportion with the increase of load, and as a rule the safety fuse will blow. In marine work, for the fuse to blow might mean disaster. In the bulk of electrical machinery for deck use, the safety fuses must only be safeguards against electrical breakdown.

With high speeds, balance of motion is very important, otherwise serious vibrations would be set up. By balance of motion I mean all turning effort forces, mass, reaction, etc. If these forces are balanced so that all forces in common balance act at ninety per cent to the common axis of motion, and all act in a common plane with their common point of action lying in the common axis of motion, then every force is neutralizing every other force, and all the energy imparted by the motor spindle to the gear is imparted by the first set of gears to the second set, and thus on until it is used in doing external work, such as warping, hoisting, etc. If these theoretical conditions existed, the gear efficiency would be 100 per cent, but such conditions are impossible. It is possible very nearly to balance all forces, but it is impossible to avoid a certain amount of friction. The friction with which I have to deal always falls under the law of friction between two solids, therefore the loss of energy due to friction is directly proportionate to the pressure between moving parts. As all forces are balanced, the only pressure between moving parts takes place at the planet studs and the faces of wheel teeth. At these points the relative movement is very small, the contact surface is large in proportion to the pressure acting on it, therefore the loss of energy is small, and as the wear of parts is always proportionate to the frictional energy wasted, it follows that the wear of parts is small. From tests made on this gear it was found that the gear efficiency increased as the load was increased; thus the gear assists the motor on heavy loads, and the current consumption of a motor thus geared may be looked upon as directly proportionate to the load. One of the great advantages of this gear from a constructional point of view is that every part is acted upon by known forces, the majority of them being simple shearing forces, therefore it is an easy matter for the designer to calculate every tooth and pin, allowing an equal factor of safety throughout without any fear of unknown influences disturbing or affecting the structure.

In arranging any warping, hauling, or hoisting mechanism comprising a motor, gear, and winding apparatus, I always design it so that of itself it is a complete structure, having the main casting in one piece, and such that it is always subjected to the lateral stress of the rope; thus the driving motor and the gear are only subjected to balanced turning effort. Then regarding the space occupied by this gear. A fifty-to-one reduction was fitted to a five-horsepower motor. The overall dimensions of the gear case were ten and one-half inches diameter by three and one-half inches wide. Pinions meshing into each other did not differ in diameters more than two and one-half to one. To give a reduction of 350 to one at five horsepower, the gear added to the motor would only require to be five inches instead of two and one-half inches, as in the former case. Such gears when fitted to the vertical spindle motor and lubricated with thick black cylinder oil, and after being a short time in use, run perfectly silently and without the slightest vibration.

Were it not for the low efficiency, steam is an ideal prime mover for warping and hoisting machinery. Its compressive or cushioning properties are exactly what is wanted. For instance, a steam capstan when warping on board ship automatically slows down as the tension on the warp increases. When the extension exceeds a certain limit the capstan will stand with the steam pressure on. To be a success an electrical capstan must do likewise. If it cannot do so it is a failure. This is where electricity fails, because an electric motor keeps up a constant speed quite independent of the pull on the warp. The current increases as the pull, but the speed remains constant. To get over this difficulty an electrical control is used. I have, however, already decided against any electrical control on the motor. I have before given certain reasons for doing so, but here I will give yet another. Electricity has practically the same velocity as light. There is a certain time element in its heating action to cause fusing, etc. I hold that the most alert men we have are not sufficiently alert to deal by hand with electrical energy supplied to an electrical capstan. One slip in the operator's actions blows the safety fuses, and the ship is left to the wind. I propose to make the warping action of the capstan almost entirely automatic. I propose attaching to the circumference of the internal toothed wheel a magnetic, disk, or oil clutch which can be tuned to slip at a warping pressure below that necessary to blow the safety fuses. When such a capstan is warping it will warp at full speed until the warp is under full tension. Then it will automatically stop, and when the tension is slightly slackened it will recommence warping. It will continue in this way until the ship is warped to its destination. The fuses will not blow unless an electrical breakdown occurs.

An electrical apparatus has one very decided advantage over one driven by steam. Steam machinery can never exert more pull than there are pounds pressure of steam on the pistons, whereas an electric motor can develop almost any power for a short interval. Owing to the possession of this property, an electrically driven windless could entirely defeat a steam windlass if extracting a fouled anchor or at any similar process.

QUESTIONS and ANSWERS

RECHARGING DRY CELLS.—What methods can be used to recharge a depleted dry cell?—J. D., Philadelphia, Pa.

A dry cell that has "run down" somewhat, but whose internal resistance has not increased very much may be "revived" to some extent by charging it with an electric current not to exceed one-half ampere. This is done just as in charging a storage battery, that is the positive terminal of the circuit must be connected to the positive pole of the dry cell and similarly the negative terminals are to be connected together; if a 110-volt circuit is available, a sixteen-candlepower lamp should be put in series with the cell to cut the current down to one-half ampere or less. It should be noted, however, as the chemical action in a dry cell is reversible to only a slight extent, the efficiency of such a recharge is extremely low, that is, but a very small part of the electrical energy put into the cell will be recovered during its further use. Moreover, as the initial cost of a dry cell is so low and its service in its proper field so long and satisfactory, it is much more economical to throw the cell away when it is depleted and to secure a new one, than to attempt to recharge it electrically or chemically. The latter is generally inexpedient, because when the cell is depleted the chemical activity of all its parts, except the inexpensive carbon, is usually exhausted.

JOINT USE OF CONDUITS FOR ELECTRIC CABLES AND STEAM PIPES.—What is the method generally used for running exhaust-steam heating mains and electric light and power feeders when they are both in the same trench? Is it practical to run the ducts for the wires under the steam pipes and have the steam pipes run through the center of the manhole?—J. F. P., San Francisco, Cal.

It is not very good practice to run electric cables in an underground conduit adjoining steam pipes, because the heat from the piping system deteriorates the insulation of the cables and any leakage of steam or water is apt to cause serious damage to them. Outside of tunnel construction, it is therefore not common to use the same trench for steam pipes and electric wires. Where it is imperative to put both in the same trench because of inability to secure a permit for further street opening, it is necessary to use the most perfect insulation for each system and to place the two systems not above each other, but side by side for accessibility. Paper-insulated, lead-covered cables are used for the electric system and a thorough heat-insulating pipe covering for the heating system. Each system is, of course, further protected by being laid in tile or concrete duct, an independent line of ducts, separated as far as possible, serving for each system. Independent manholes should be provided for each system.

INTERCHANGEABLE MOTORS FOR VACUUM CLEANERS.—What kind of motor operates either on direct-current or alternating-current, such as certain small vacuum cleaners use? What size of motors can be operated in this way?—J. H. C. B., Manitowoc, Wis.

The series compensated commutator motor can be used for either direct-current or single-phase alternating-current circuits. Although for electric-railway service they have been made in large sizes, they have not yet been extensively used in general service. A line of these motors in sizes up to one-fourth horsepower has been employed on certain vacuum cleaners and is said by its manufacturers to give equally good results on both kinds of current. They are also used to a limited extent for small fan motors. When operating on alternating-current circuits they do not give quite as high an efficiency as on direct-current circuits of equal voltage. If used for more than short intervals they are also apt to give more trouble from sparking and heating on alternating current than on direct current.

CURRENT DENSITY IN BRUSHES.—How many amperes per square inch will carbon, leaf copper and wire gauze brushes carry on a commutator of a direct-current machine without sparking or heating while running continuously?—L. M., Chicago.

The following are the most commonly used current densities in amperes per square inch of brush surface in contact with the armature:

Carbon, 35 to 42 amperes.

Woven wire or gauze, 130 to 150 amperes.

Leaf copper, 175 to 200 amperes.

THREE-PHASE ALTERNATOR USED AS SINGLE-PHASE MACHINE.—How much load would a three-phase alternator pull as a single-phase machine?—M. L., Chicago.

The output of a single-phase alternator is equal to $E\ I \cos\theta$ watts, where E is the electromotive force in volts, I the current in amperes and $\cos\theta$ the power factor. For a three-phase generator the output is $\sqrt{3}\ E\ I \cos\theta$, where E is the voltage between any two phases and I the current in any of them. Consequently, if a three-phase generator is operated as a single-phase machine, that is, with a load on one phase only, the output will be only $\frac{1}{\sqrt{3}} = \frac{1}{1.732} =$ 0.577 as great as when operating as a regular three-phase machine.

EFFECT OF TEMPERATURE ON BATTERY ELECTROLYTE.—Please tell me if there is a formula by which to calculate, or a rule that may be used to tell how the temperature affects the specific gravity of the electrolyte in storage batteries. If the gravity is 1198 at ninety degrees, what would it be at seventy degrees?—J. W. H., Vinita, Okla.

An increase in temperature of the dilute sulphuric acid, which forms the electrolyte of nearly all storage batteries, increases the volume of the liquid slightly and therefore lowers the specific gravity. Between the limits met with in practice, an increase of three degrees Fahrenheit in temperature reduces the specific gravity one point and conversely a three-degree decrease in temperature increases the gravity one point. Thus, if the gravity is 1198 at ninety degrees, it will be practically 1205 at seventy degrees and 1196 at ninety-six degrees. This rule holds for a variation in temperature only, all other conditions being assumed to be the same.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CUMBERLAND TELEPHONE AND TELEGRAPH

The report of the Cumberland Telephone and Telegraph Company for the month of May and five months ended May 31, 1910, compares as follows:

	1910	1909
May gross	$ 570,195	$ 524,954
Expenses	322,540	279,454
May net	247,655	227,500
Charges and taxes	47,717	41,110
May surplus	199,938	186,390
Five months gross	2,800,846	2,643,848
Expenses	1,596,637	1,514,125
Five months net	1,204,209	1,129,723
Charges and taxes	239,311	214,282
Five months surplus	964,898	915,441

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway Company, for the month of May and five months ended May 31, 1910, compares as follows:

	1910	1909
May gross	$ 100,424	$ 89,534
Operating expenses and taxes	52,983	47,111
May net	47,441	42,423
Interest	35,035	34,581
May surplus	12,405	7,842
Five months gross	423,194	378,851
Operating expenes and taxes	246,453	229,592
Five months net	176,741	149,259
Interest	173,858	172,171
Five months surplus	2,882	22,921

MEXICAN TELEPHONE AND TELEGRAPH.

The report of the Mexican Telephone and Telegraph Company for the month of May and three months ended May 31, 1910, compares as follows (in Mexican currency):

	1910	1909
May gross	$ 45,988	$ 37,444
Expenses	21,853	17,589
May net	24,135	19,855
Three months gross	136,111	109,864
Expenses	64,426	51,983
Three months net	71,685	57,881

LONDON UNDERGROUND.

The associated companies of the Underground Electric Railways Company, of London, report for the month of May, 1910, compared as follows:

Metropolitan District Railway:	1910	1909
Gross receipts	£59,661	£52,791
Working expenses	26,442	27,296
Net receipts	33,219	25,495
Baker Street & Waterloo Railway:		
Gross receipts	£16,157	£15,004
Working expenses	7,328	7,494
Net receipts	8,829	7,510
Great Northern, Piccadilly & Brompton Railway:		
Gross receipts	£28,158	£26,381
Working expenses	14,061	14,352
Net receipts	14,097	12,029
Charing Cross, Euston & Hampstead Railway:		
Gross receipts	£18,435	£18,784
Working expenses	9,980	10,280
Net receipts	8,455	8,504
London United Tramways, Ltd.:		
Gross receipts	£32,656	£32,961
Working expenses	20,680	18,892
Net receipts	11,976	14,069
Total all companies:		
Gross receipts	£155,067	£145,921
Working expenses	78,491	78,314
Net receipts	76,576	67,697

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company reports earnings for the month of May and five months, compared as follows:

	1910	1909
May gross	$ 273,044	$ 222,327
Expenses	8,998	8,930
May net	264,046	213,397
Five months' gross	1,513,822	1,308,808
Expenses	45,629	44,137
Five months' net	1,468,193	1,264,670

NIAGARA, LOCKPORT & ONTARIO.

The report of the Niagara, Lockport & Ontario Power Company for the month of May and five months ended May 31, 1910, compares as follows:

	1910	1909
May gross	$ 40,429	$ 30,238
Net	25,656	15,675
Surplus	4,823	*5,158
Five months' gross	201,757	139,521
Net	126,847	73,518
Five months' surplus	22,680	*30,649

*Deficit.

CENTRAL & SOUTH AMERICAN TELEGRAPH.

The Central & South American Telegraph Company's estimated report of earnings for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Gross	$435,000	$365,000
Expense	162,500	163,000
Net	272,500	202,000
Other income	2,750	2,500
Total income	275,250	204,500
Dividends	143,565	143,565
Surplus	131,685	60,935
Previous surplus	1,886,151	1,495,492
Total surplus	2,017,836	1,556,427

MEXICAN TELEGRAPH COMPANY.

The Mexican Telegraph Company's report of estimated earnings, for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Traffic Receipts	$207,000	$165,000
Expenses	42,500	41,000
Net	164,500	124,000
Other income	26,000	21,000
Total income	190,500	145,000
To Mexican government	9,500	7,500
Balance	181,000	137,500
Dividends	89,735	89,720
Surplus	91,265	47,780
Previous surplus	2,307,874	2,091,611
Total surplus	2,399,139	2,139,391

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of May and eight months ended May 31, compares as follows:

	1910	1909
May gross	$370,234	$329,339
Expenses	199,617	181,147
May net	170,617	148,192
Charges	54,435	45,891
May surplus	116,182	102,301
Eight months' gross	2,707,235	2,437,056
Expenses	1,607,443	1,501,283
Eight months' net	1,099,792	935,773
Charges	318,550	284,557
Eight months' surplus	781,242	651,216

KINGS COUNTY ELECTRIC LIGHT.

The report of the Kings County Electric Light and Power Company for the month of May and five months ended May 31 compares as follows:

	1910	1909
May gross	$ 340,101	$ 297,677
Expenses	169,380	146,528
May net	170,721	151,148
Charges	100,773	88,567
May surplus	69,948	62,581
Five months' gross	1,754,154	1,536,768
Expenses	824,400	725,742
Five months' net	929,754	811,026
Charges	507,025	438,261
Five months' surplus	422,729	372,765

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE WEED ELECTRIC COMPANY, Eugene, Ore., installed the lighting fixtures in the Eagles' Building in that city.

THE BUFFALO ELECTRIC COMPANY, of Buffalo, N. Y., has the contract, at $150, for electric wiring in the addition to the guardhouse at Fort Porter, N. Y.

NICHOLAS H. THORPE, New York, N. Y., has been awarded the contract for construction, repairs and wiring and fixtures at Governor's Island. The contract price for the work complete was $1,240.

THE ROSEBERRY-HENRY ELECTRIC COMPANY, Grand Rapids, Mich., was awarded the contract for installing conduits and wiring for the electric call-bell service in the United States public building in Grand Rapids.

THE MARSHALL-WELLS HARDWARE COMPANY, of Duluth, Minn., was recently awarded the contract for installing electrical equipment in the lighting plant at Aurora, Minn. The contract price for work on the plant, which is a municipal one, was $2,300.

THE F. E. NEWBERRY ELECTRIC COMPANY, St. Louis, Mo., was awarded the contract for installing conduits and electric wiring and gas piping in the United States postoffice, St. Louis, Mo. The time for completion of the contract is December 31, and the price $15,588.

THE STAR ELECTRIC COMPANY, Woonsocket, R. I., has secured the contract to wire, install lights, switchboards and motors in the new Samoset mill at the Cold Spring. Between 600 and 700 Tungsten incandescent lamps will be used to light the plant. The machinery in this mill will be direct driven by three-phase alternating-current motors, aggregating approximately 750 horsepower.

The city council of Des Moines, Iowa, has given permission to the architects of the new city hall to install smokeless furnaces under the boilers for use in that building.

New Electrical and Mechanical Apparatus and Appliances.

MAKING HARD RUBBER FOR TELEPHONE USES.

BY F. S. MALM.

Hard rubber plays an important part in the manufacture of telephones and telephone apparatus. Receiver shells, transmitters and many other objects just as familiar to every telephone user are made from vulcanized rubber either alone or in composition.

At Hawthorne, Ill., situated in the group of buildings which constitute the largest telephone manufacturing plant in the world, is located the Western Electric Company's hard-rubber factory. The company found that it was able to save a considerable profit which formerly went to middlemen by making its own hard rubber, and at the same time was able to assure its customers of the quality of this portion of its telephone product. Its well-equipped rubber plant now plays a prominent part in the maintenance of the high standard of its "Bell" grade apparatus.

FIG. 1.—RUBBER INSPECTION DEPARTMENT.

FIG. 2.—SECTION OF VULCANIZING ROOM.

Rubber is a product of several species of trees, vines and shrubs. These occur in the torrid zone, but the rubber that comes from different parts of this vast belt differs greatly in its physical and chemical properties. Rubber results from the juice "latex" of a tree or vine, a milk-like fluid holding small globules of rubber in suspension, and other substances in solution. The latex is obtained by cutting incisions into the bark of the tree and allowing it to drip into receptacles, after which the rubber is separated out by coagulation.

Para rubber coming from South America is the best quality of all rubber. It results from the latex taken from the gigantic tree, the *Hevea Braziliensia*. Para rubber, which the Western Electric Company uses, comes in the form of large biscuits which possess an odor similar to smoked ham, and has a strength and elasticity which is unapproached by any other grade of rubber. It contains approximately twenty per cent of water, as well as a small amount of dirt and other impurities which must be entirely eliminated before it can be used in hard-rubber manufacture. Numerous grades of rubber come from Africa, Asia and Madagascar. Most of these grades result from the latex of the giant vine of the *Landolphia* species.

In spite of the best methods of coagulation, it has been found impossible to rid the rubber of such impurities as sand, bark from the tree and water, which causes the high shrinkage of many rubbers now on the market. All lots of crude rubber coming to the Hawthorne plant are inspected, and owing to the fact that all rubbers vary in cleanliness, the dirtier proportions are given especial attention in the washing operations. The crude rubber is first softened in hot water, this being done in a large steel tank with a capacity of several tons.

The washing equipment consists of washing mills, provided with corrugated rolls, and a water pipe carrying wash water running parallel to the rolls along their whole length. The pipes are perforated and thus allow a constant stream of water to play upon the rubber while it is being passed between the rolls. The time required to wash crude rubber properly will depend upon its condition, as in every instance it must be done so effectually that after being washed and dried the rubber must show a percentage of mineral matter under a certain definite figure before it can be used. In this way all contamination of hard rubber with such injurious substances as sand and bark will be removed. After the rubber has been thoroughly washed, it is passed between the rolls of a finishing mill, where it is rolled down to a thickness of one-eighth of an inch.

It is absolutely necessary that all rubber before being put into a mixture shall have become perfectly dry. To accomplish this a large drying room, provided with racks upon which the sheeted rubber is hung until dry enough for use, is employed. The time for drying varies with different grades of rubber. The drying room is equipped with heating pipes and adequate ventilation so that the temperature may be controlled at all times.

Hard or soft rubber can be made

by varying the percentage of sulphur, but the proportion forty per cent of sulphur and sixty per cent of rubber, vulcanized at the proper temperature, will produce the best hard rubber. Nothing can be found which can be used so effectively for a vulcanizing agent as sulphur. The form of sulphur used in making hard rubber is that known commercially as "flowers of sulphur." It is the ordinary octahedral sulphur, melting at 238 degrees Fahrenheit. Commercially it contains a small amount of moisture and also from 0.1 to 0.2 per cent of sulphur acid which has been formed by oxidization. The combination of sulphur and rubber is brought about mainly by heat. No vulcanizing action at all takes place before the melting of sulphur, and it proceeds very slowly at temperatures under 250 degrees Fahrenheit.

The nature of vulcanization is very little understood. Some claim it is a solution of rubber in sulphur; others affirm that surphur merely adds itself to rubber as an addition product similar to action of sulphur upon certain vegetable oils. Others, again, say that the process is a substitution process and that sulphur replaces part of the hydrogen in the rubber, with the formation of hydrogen sulphide.

The most plausible of all these explanations at the present time is the second—that vulcanized rubber is an addition product of rubber and sulphur. When a piece of rubber is vulcanized properly with sulphur, no evidence of sulphur can be seen in the piece. Even upon heating above the melting point of sulphur no sulphur globules can be seen oozing from the piece. That the sulphur has changed is evident, for when the same piece of vulcanized rubber is extracted with boiling acetone in which sulphur is soluble, only a small part of sulphur can be dissolved out. When hard rubber contains more than thirty-three per cent of sulphur the balance will remain in the free state.

In making hard rubber at the Hawthorne plant the requisite kinds of rubber and the required percentage of sulphur are weighed out and thoroughly mixed on mills. The resulting mixture is cut from the mills, rolled into convenient-sized lots and is taken from here to the various departments where it is to be made into hard-rubber parts. Hard-rubber sheets are made in the well-known way, by warming up on the mill and calendering the rubber to size. The equipment consists of a large calender, which is a machine used for rolling the rubber out into a definite sized sheet. The sheets of rubber are in turn placed in cars and put into large vulcanizers. These vulcanizers are heated by steam, the heat being increased very carefully and gradually. The length of vulcanization depends, of course, upon the size and quality of the sheets to be made.

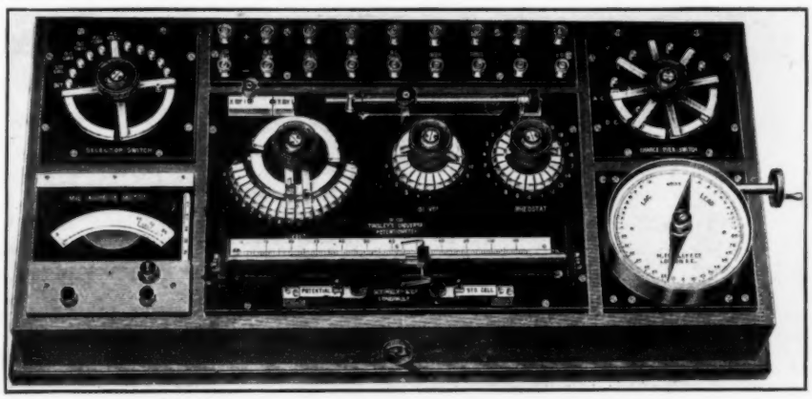
Rods and tubes are made from rubber mixtures on regular tube machines, which consist of a steam-jacketed cylinder in which a forcing screw is revolved, causing the rubber which is fed into the cylinder to be squirted out through a sizing die. After this operation they are vulcanized in vulcanizers similar to those in which sheets are made. The tubes are made similar to rods with the exception that the central hole is formed by the aid of a pin in the tubing machine. After leaving the tubing machine the tubes are placed on steel rods on which they are vulcanized to obtain a tube with definite size hole. The rods and tubes after vulcanizing are finished to size, and, if necessary, buffed and polished.

Hard-rubber receiver parts are made from rubber mixtures which are milled and calendered as for sheets. These sheets are then cut into blank pieces which are placed into metal dies, pressed into the required shape and vulcanized. The dies in which these parts are vulcanized are placed in a steel form so arranged that a certain number of dies can be heated at the same time. The mixtures of rubber used are of course adapted to the particular use to which the parts are put.

New Potentiometer.

There has recently been placed upon the European markets, by H. Tinsley & Company, South Norwood, London, the potentiometer shown in the accompanying illustration. This is said to be the first instance of an instrument in which the actual phase relation of voltage and current can be directly read off on a dial in degrees or power factor, at the same time that the value is accurately measure by a potentiometer method, thus insuring all the advantages of range and proportionality of readings exactly as in direct-current work.

The instrument consists of a standard form of direct-current potentiometer to which is added a dynamometer for indicating the current in its coils. A phase-shifting transformer is added in the right-hand bottom corner by which this current can be brought into correct phase relation with the current that is being measured, by simply turning a tangent screw.



ALTERNATING AND DIRECT-CURRENT POTENTIOMETER

By means of a change-over switch the potentiometer is either fed with direct current from a battery and used with a galvanometer in the ordinary manner or fed with alternating current from the phase-shifting transformer and used with a vibration galvanometer or other alternating-current detector.

The instrument is most conveniently designed for the rapid and accurate measurement of both direct and alternating currents and voltages. Vector diagrams, which have been drawn from its readings, show a remarkably good result, even when measuring alternating currents in a condenser or across an inductive coil.

Vertical Carbon Flame Arc Lamp for Direct-Current Series, Multiple and Multiple Series Service.

The efficiency, pleasing appearance, and quality of light which characterizes the flame arc lamp has rendered it pre-eminently adapted for the economical illumination of large areas, and it is now generally conceded that the flame arc lamp is a most efficient illuminant, and that the penetrating quality of the brilliant, golden yellow light is such that even under the most adverse atmospheric conditions, such as those imposed by fog or smoke, it provides a highly satsifactory illumination.

Previous to the advent of the 6.6 ampere vertical carbon direct-current flame arc lamp manufactured by the General Electric Company, the installation of flame arc lamps on 6.6 ampere direct-current circuits was not entirely satisfactory on account of the large and wasteful resistance necessary. This new lamp is designed for connecting directly in a 6.6 ampere direct-current circuit without any change in the system, simply replacing the other lamps where desired.

Although these lamps are now made for direct-current service only, they find a wide application, being suitable for lighting squares, parks, or special store sections in cities where the 6.6 ampere series luminous arc, or the series direct-current enclosed 6.6 ampere systems is used for street lighting. They are adapted for multiple and multiple series service in addition to the above.

The lamps are equipped with a light opal globe and a twenty-six-inch diffuser. The casing, which is of copper with black oxidized finish, is made up in two sections so arranged that, by telescoping the sections, the mechanism is exposed, rendering it unnecessary to remove the entire casing in order to see that the lamp is properly trimmed.

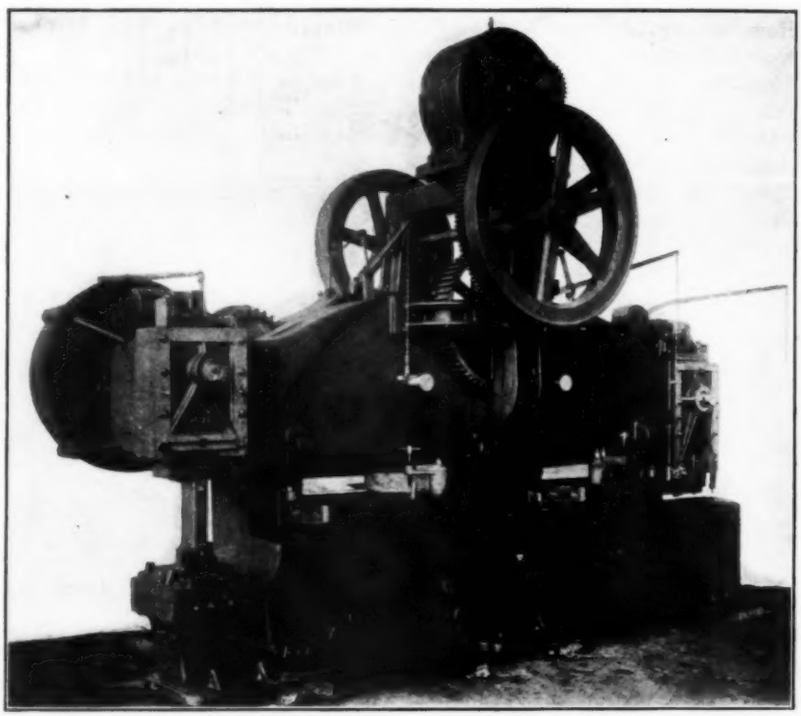
The arc is held in the same position at all times, as the mechanism is of the focusing type. With the exception of this feature, the lamp mechanism is similar to that used in the standard direct-current inclosed lamp, which has given perfect satisfaction during years of service.

The lower carbon holder is provided with a ball and socket joint to allow perfect alinement of both carbons. A life of about twenty hours is obtained with one trim when the lamp is adjusted for 6.5 amperes. The design and the materials used are such as to combine attractive appearance, great strength and durability.

This increased efficiency, combined with the fact that lamps may be connected directly in the circuit offers the central stations operating direct-current an opportunity to take over the lighting of founderies, wharves, etc.

Universal Shears for Channels, Angles and Plates.

The accompanying illustration shows a view of a motor-driven universal shear for squaring and mitering channels, angles and plates, used in structural steel work. This machine was built especially for the Marine Department of the Maryland Steel Company, Sparrows Point, Maryland, but would be found very useful in any iron works where steel forms must be cut for construction work.



MOTOR-DRIVEN SHEARS FOR CUTTING CHANNELS, ANGLES AND PLATES.

This machine has a coping attachment at one end, a plate shear at the other and two intermediate forty-five-degree angle shears. The coping attachment can also be used as a punch. The plate shear will cut angles up to six inches by six inches by one inch, or eight inches by eight inches by three-fourths inch, and channels up to fifteen inches by three-fourths inch. Each shear is controlled by its own clutch, and the machine can be operated simultaneously by three groups of men without interfering with one another.

The frames, plungers, pendulums, clutches, and all parts subjected to severe shocks are semi-steel castings. The shafts are made from hammered steel containing from .4 to .5 of one per cent carbon. The gears are provided with long hubs which extend through the gear casings. Particular attention has been given to obtaining satisfactory lubrication for all bearings. An especially designed automatic stop motion on each shear throws out the clutch when the shear reaches the highest point of its travel, while a similar automatic stop on the coping device is adjustable, thus allowing the plunger to be stopped at any predetermined point in its downward stroke.

The net weight of this machine is approximately twenty-three tons and it is designed throughout for long life under most severe service. It is built by the Covington Machine Company of Covington, Va., and is equipped with a twenty-five-horsepower type S direct-current motor manufactured by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

THE MEGGER—AN INSTRUMENT FOR INVESTIGATION OF THE CONDITION OF INSULATION.

BY ARTHUR J. ROWLAND.

One of the things which it has been most difficult if not impossible for an electrical engineer to know about is the condition of the insulation in the apparatus upon his system. A failure in the insulation of a dynamo or cable may lead to most serious consequences in a generating station or even in a whole system. One little fault may produce thousands of dollars worth of damage and cause a shut down, the result of which will be not only a direct money loss, but also a loss of the sense of security of service on the part of customers—a most valuable asset.

In modern practice apparatus is tested for break-down by the application of alternating electromotive force at high voltage, usually at the works of the manufacturer, and then throughout the period of use the owner takes the chance of break-down. The apparatus which has been available for the purpose of detecting insulation faults shows them only after they have developed. Most central-station engineers do not place much dependence on tests or instruments. They seem to take the view that defects in insulation cannot be anticipated and the results of defects, when they come, are to be expected, like other things which are inevitable. It is simply their part to be always alert and ready to meet the emergency when it arrives.

Everyone knows that insulation is said to have two properties; one its insulation resistance and the other its strength to withstand break-down. Whether failure of insulation is due to a diminishing resistance which allows more and more current to leak through it until at last the break-down comes, or due to an actual disruptive break-down, cannot be here discussed. On given apparatus we know it is unsafe to apply a break-down test—it may be unsafe to apply normal electromotive force when the insulation resistance is low. On given apparatus a constant deterioration in insulation resistance is direct evidence of impending failure or break-down. It is certain at least that for given materials a low insulation resistance and a low strength against break-down go together. For example, doubling the thickness of an insulator increases both the insulation resistance and the break-down voltage. It is then of importance to know something about insulation resistance for all sorts of commercial apparatus. Up to recent years, however, the intricacy of apparatus and the involved measurements necessary if high resistance is to be measured, and the lack of necessary sensibility in apparatus of simple construction for lower values, has made it impossible for most people to really keep track of a thing which is of the highest importance where a continuance of safe operation is desirable.

A few years ago a direct reading insulation resistance instrument was invented by Sidney Evershed. Under the name of the Megger this has been manufactured for several years in England.

It has come to be well known and its value to be well understood in some parts of the world.

The Megger complete and ready for use is illustrated in Fig. 1. This shows the instrument one-sixth of full size. The insulation resistance to be investigated is connected between the binding posts, one of which is marked "line" and the other "earth." The crank is turned at fair speed and the amount of insulation resistance in megohms read from the scale. The whole process requires a few seconds; the operation can be conducted by anyone.

FIG. 1.—THE MEGGER.

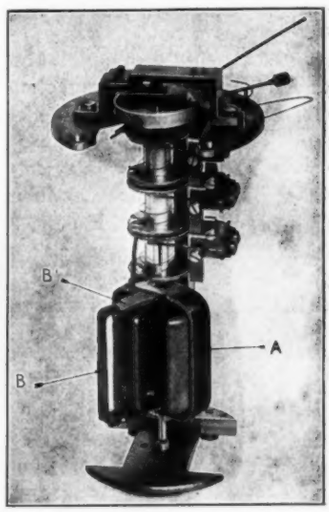


FIG. 4.—THE MOVING SYSTEM.

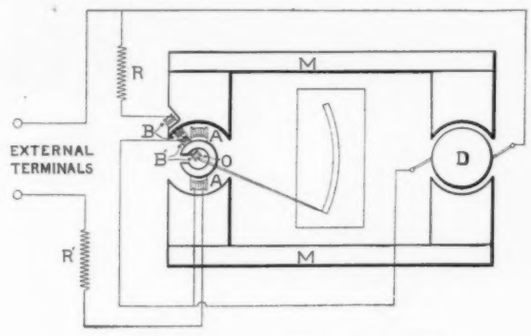


FIG. 2.—DIAGRAM OF INSTRUMENT.

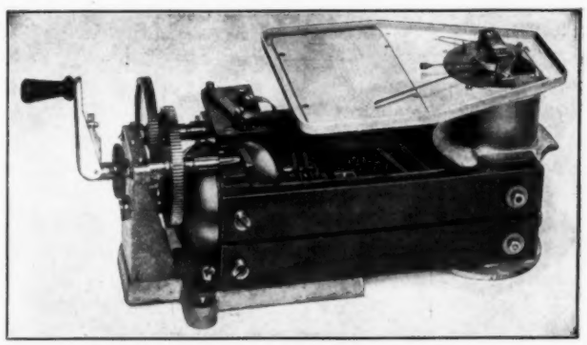


FIG. 3.—AN INTERIOR VIEW.

The Megger is portable, weighing about twenty pounds. It is self-contained and is not affected in any way by its surroundings. The scale may be marked up to 2,000 megohms.

In Fig. 2 is shown diagrammatically the arrangement of the interior parts. Figs. 3 and 4 show the interior construction and the moving system respectively. Referring to Fig. 2 we see that permanent magnets M M are so arranged that a closed magnetic circuit is formed. In this magnetic circuit at one end a pair of pole pieces are placed between which a dynamo armature revolves. At the other end is another pair of pole pieces, within the field of which the moving system works. The dynamo, driven by the crank placed as shown in Fig. 1, furnishes the electromotive force by means of which the instrument operates. It usually supplies either 250 or 500 volts; and this is generated on a drum armature by a winding so arranged that the various coils end on commutators of peculiar disc form, the edges of which at opposite sides are gripped by spring washers.

The moving system is made of three coils rigidly connected to each other (see Figs. 2 and 4). Tracing out the connections it will be found that the coil A A of the moving system is in series with the apparatus under investigation through resistance R′. It is the deflecting coil and exerts a deflecting force in the field where it is placed proportional to the current in it. Coils B and B′ are connected in series. They, with resistance R in series, are put directly across the dynamo terminals. They constitute the controlling coil of the instrument, the amount of their restraining force being a function of the position they take. As shown in Fig. 2, the indicating needle points to zero on the scale; coil A A has large current in it and coils B B′ are exerting a maximum restoring force. Reference to Fig. 4 will show how the moving system is assembled. The current is led in and out of the coils through very slender copper ribbons which produce no torque; there are no springs; the needle takes a position determined wholly by the torque of current in the magnetic field.

This instrument is being placed on the market by James G. Biddle, sole agent for the United States, at 1114 Chestnut Street, Philadelphia, Pa.

Federal "Win-do-lite" Sign.

The rich color effects in leaded art glass, obtained by the expensive leaded art glass shades and domes used in modern lighting, have been applied to store window illumination only in a few instances, owing to high first cost. By combining the source of window illumination with art glass screen the expense of such illumination has been overcome in the Federal "Win-do-lite" sign, and at the same time the pleasing effect retained.

The art glass screen or sign is formed of individual plates made of art glass the various pieces of which are heavily leaded together, each plate

END VIEW OF FRAMEWORK.

having one edge grooved and the other edge rounded so that when assembled in the runners or guides of the frame, the edges of adjacent plates make lightproof or tongued-and-grooved joints. Each sectional plate contains a single character letter, punctuation mark or space.

All sectional plates being interchangeable, the position of extra plates bearing different characters permits of the reading of the sign being changed at will. A large number of words, combinations or announcements are thus possible with even an eight foot frame and some extra sectional plates.

The frame work of the fixture consists principally of a light but strongly trussed steel frame, having brass bound parallel runners or guides at the top and bottom. Electric lamp sockets are placed at regular intervals along the under side of the top truss rod which is used as a conduit for all the electric wires. The truss rod is fastened with a clamp which permits the turning of the rod so that all the sockets can be adjusted to any angle.

The curving of supporting brackets well away from the inner face of the sign is a most important feature as they are thereby removed from the line of light.

The "Win-do-lite" sign occupies space not otherwise utilized and is illuminated by light that lights the window at no additional cost. The reflectors being adjustable to any angle reflect the light to best advantage upon the window display, the small amount of light which escapes through the shades being all that is necessary to illuminate the sign. These signs in various sizes and color designs are being manufactured and placed on the market by the Federal Electric Company, Chicago, Ill.

Electrical Hardware.

Electrical hardware, detail apparatus, house goods—these are but three of the several names given to all of the many small pieces of electrical apparatus used for convenience in modern buildings.

Annunciators; bells and buzzers; burglar alarms, with a dozen types of springs to fit windows, transoms, doors, etc.; heating devices, including chafing dishes, percolators, electric irons, warming pads, curling-iron heaters; fire-alarm thermostats; dozens of types of lighting fixtures; medical batteries; push buttons, in all the different forms and finishes, arranged for ringing one or many different bells; electric massage vibrators; watchmen's registering systems; door switches for automatically lighting a lamp when a door is opened; convenient lamp holders with adjustable cord for taking an electric lamp into a closet or other places not regularly lighted; washing machines; vacuum cleaners; sewing-machine motors; inter-phones, etc.

To try to list and describe all of these is a task which is never completed, because each day brings a new development in this line. However, a bulletin entitled "House Goods" has recently been issued by the Western Electric Company covering the smaller sizes of this apparatus.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 8.—Yet another judicial decision has been given concerning the question of municipal wiring and fitting. Following on the recent case in which it was held that the Leicester Corporation had been acting illegally in wiring consumers' premises and selling fittings, comes a case at Canterbury in which the judge expressed even more pronounced views. The Canterbury case is of greater interest because it occurs in relation to the scheme which was started some years ago under which a company wired houses free for electric light, the corporation as the electric supply authority, charging an extra penny (two cents) per kilowatt-hour, for electricity, which was paid over to the company. A difficulty arose, however, in connection with one house, the original tenant of which—who had agreed to pay the extra penny per unit—had left and the new tenant refused to pay this additional toll, on the ground that he had not entered into any agreement for the premises to be wired. Nevertheless, the corporation continued to supply him with energy, and the company sued for its one penny per unit on this consumption. The Leicester and Canterbury cases are really splendid examples of contrast. Whereas, on the one hand, Leicester Corporation, to justify their action, contended that the electric lighting acts do confer wiring powers upon the municipalities, the Canterbury Corporation, in order to avoid paying the extra penny per unit under an agreement, contended that they were not only not entitled to wire premises, but also they were not allowed to pay a contractor for doing it for them. They were successful in this contention, for the judge has held it to be ultra vires to have entered into any agreement for wiring through a contractor. There are thus two very clear pronouncements that the electric lighting acts do not confer wiring powers upon municipalities, and the result will no doubt be a determined effort to get a special act passed through Parliament, to remedy this state of affairs, at the earliest possible moment.

The artistic and other gentlemen who have banded themselves into smoke prevention associations in England are still bestowing considerable attention upon industrial works. Following on the unsuccessful efforts of the London County Council to broaded its powers of prosecution under the public health acts, a deputation of smoke abatement and similar societies has waited upon the president of the Local Government Board with a view to further legislation. Like so many other people who have been aiming at reform in this direction for years, the domestic chimney seems to be left out of account as hopeless to legislate for and they are concentrating all their attention upon such undertakings as electricity works, gas works and so on. Fortunately, the anomaly of this attitude was pointed out by the president of the Local Government Board, and the societies have come in for some strong criticisms at the hands of the technical press which rightly points out that the smoke problem is being solved, to a considerable extent, by the very undertakings which the smoke prevention societies are constantly seeking to harass, by further legislative restrictions.

The committee which was recentiy formed for the "Protection of Electrical Interests" in Great Britain, is now actively at work and a large number of matters are under consideration. One of the most important, is the formation of a Parliamentary section, formed of members of Parliament, which will watch over the interests of the electrical industry in the House of Commons.

Owing to a possible clashing of names, the name of the newly formed Institution of Mining Electrical Engineers has been changed to the Association of Mining Electrical Engineers, to prevent confusion with the Institution of Electrical Engineers. The latter, by the way, is now settled in its own home on the Thames Embankment.

It is expected that the revised Home Office rules relating to the use of electricity in mines will be issued before the end of the summer. This revision has been the subject of many questions in Parliament and has assumed considerable importance by reason of the fact that the committee which has been considering the present regulations was formed mainly in response to suggestions from certain quarters that electricity should be prohibited in mines. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 8.—A new type of electric locomotive is to be used on the Bernese Alps electric railroad which passes through the Lotschberg tunnel. These locomotives are now being constructed in Switzerland and they are designed to run at the maximum speed of fifty miles an hour. The weight of the locomotive is ninety-four tons, in which the electrical outfit figures for forty-six tons. Double bogie mounting is used here, and each of the bogies has three axles. A single monophase motor drives all three axles by crank coupling, so that it will be seen that this type differs considerably from the Simplex locomotives. The motors are of the 1,000-horsepower type and have a single reduction gearing with countershaft. On the locomotive is a 15,000-420 volt transformer for each of the motors.

There will soon be but few of the light railways or tramways in the region of Paris which use steam. One of the tramways which it has been decided to change over from the steam system is the line which runs from Versailles to Reuil. Within the city, there will be but three systems prevailing, seeing that animal traction will soon be entirely replaced by the autobus. We have left the numerous compressed air lines which will likely continue working for a long time to come, and the electric lines on the underground conduit or surface contact systems. While there has been a great extension in the electric tramways running to the suburbs, this has not been the case within the city limits, owing to the fact that the trolley is not allowed and for this reason the outlay for installing electric lines is very great.

In Russia there are to be erected light and power stations in the localities of Novgorod and Rowno; also at Piatigorsk in the Caucasus region. Electric lighting extensions are being promoted in Vladivostock and Kiev. Tiflis and Poltara will soon be supplied with electric traction lines. Petrol-electric trains will be used on the new traction system which is to be built between Hilversum and Bussum, Holland. A tramway line is to be installed between Gouda and the cities of Utrecht and Rotterdam.

The International Tramway Union, whose headquarters are at Brussels, is taking an active part in organizing the coming tramway and light railroad congress. It will be held at Brussels during the exposition, from September 6 to 11. Various excursions will be an attractive feature of the congress.

One of the leading firms to be engaged in aluminum production in Switzerland, is the Aluminum Manufacturing Company, and it is now taking measures for increasing the number of plants which it controls. It is already operating the works at Neuhausen (4,000 horsepower) and Rheinfelden (5,000 horsepower), but the new plants which it will erect on the Rhone will be of much larger size. No less than 40,000 horsepower will be available at Chippis and on an affluent of the Rhone, the Navigance, there can be obtained 20,000 horsepower. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JULY 18.—The lease of the Wawaican Falls power, on the Mattagami River, in the Cobalt silver mining region, has been purchased by the Mines Power Company. This power, which is said to be one of the best in the north country, is situated on the Matagami River. The nature of the falls is such that development is very easy, and a total of between 6,000 and 7,000 horsepower can be obtained throughout the entire year.

At a meeting of the shareholders of the Shawinigan Water and Power Company, the directors were authorized to issue, as required, additional common stock of the company to the amount of $3,000,000. This arrangement will provide all funds necessary to cover the work in hand for the extension of the company's power plant at Shawinigan Falls, Que., which extension will ultimately double the company's electrical capacity by adding thereto 75,000 horsepower, and also cover the expense of acquiring a substantial interest in other companies in which it is affiliated.

Work on the transmission line of the Ontario Hydroelectric Commission is nearly completed. All the towers are erected, and the wires are strung on the end of the section covering Guelph and Dundas, Ont. The fifteen transformer stations, where the power will be stepped down for commercial uses, are about ready for the turning on of the power. It is likely that the section from Niagara Falls, via Guelph, Berlin and Stratford, will be finished first.

It is understood that already sufficient progress has been made in the preparation of an inventory of the waterpowers of Canada, so far as known, as to warrant their division into two classes: those now under public control, and those that have passed into private hands, with an addition, in the latter case, of the length of term during which private ownership will last. The desire of the Dominion conservation commission is to secure for public use, as many of the undeveloped water powers as possible, and it will probably recommend the government to allow no further grants of water powers except upon terms that will permit of the resumption of such powers by the government upon fair terms.

The report of the Mexican Light and Power Company for the year shows that while the completion of construction work and the consequent securing of ample water power is not complete, gross

earnings amounted to $3,014,325 gold, as against $2,938,474 in the previous year. To this has been added $60,823, the balance of surplus profits carried forward from previous year, making a total of $3,075,148. From this has been deducted $648,337, as general operating expenses, making the net revenue for the year $2,426,811, out of which management, fixed charges and the seven per cent preferred dividend have been paid, leaving a surplus of $1,186,527. From this surplus one-half of the extraordinary expenditure in connection with the steam plant has been deducted, and a four-per-cent dividend on the common stock has been paid leaving $144,386 to be carried forward. W.

LIGHTING AND POWER.

(Special Correspondence)

BRIDGEWATER, S. D.—An electric light plant is to be installed by this city. P.

AURORA, MINN.—Bonds for $10,000 have been voted for an electric light plant. P.

BROWNSVILLE, TEX.—This city is to spend $15,000 in improving its electric light plant. P.

OSSIAN, IA.—C. Miller & Sons, of Clermont, have been granted an electric light franchise here. P.

DELANO, MINN.—George Florida is considering the establishment of a small electric light plant. P.

CANTON, KAS.—This city has voted $30,000 in bonds for an electric light and waterworks plant. P.

OSAGE, OKLA.—The Osage Land and Development Company will construct an electric light plant. P.

ILLMO, MO.—The Illmo Light and Power Company has been incorporated with a capital stock of $4,000. P.

GRANITE FALLS, MINN.—Bonds for $27,000 for the construction of a new dam at the powerhouse have been voted. C.

FAIRFAX, MO.—The Fairfax Light, Heat and Power Company has been incorporated with a capital stock of $4,000. P.

LA CROSSE, WIS.—It is proposed to take a vote in September on issuing bonds for $50,000 for a municipal lighting plant. C.

ENGLAND, ARK.—The Richwood Gin Company is increasing its capital stock and proposes to put in an electric light plant. P.

AURORA, MINN.—The city clerk will advertise for bids on transformers, meters and wire to be used in the municipal lighting plant. C.

ALTUS, OKLA.—The J. W. Maxcy Company has been awarded the contract to do $25,000 worth of improvement to the electric light plant. P.

VIRGINIA, MINN.—The purchase of the light and water plant of the Virginia Electric Power and Water Company, by the city, is being agitated. C.

BEATRICE, NEB.—The plant of the Beatrice Electric Company has been sold to E. J. Sullivan, of Omaha, Neb., who will make extensive improvements. C.

PHILADELPHIA, PA.—The Pomeroy Construction Company has plans for an addition to the powerhouse of the Girard estate, at Twentieth Street and Oregon Avenue.

FORT WORTH, TEX.—There have been added to the street lighting system of this city 400 tungsten lamps and 250 arc lamps from the proceeds of the recent $25,000 bond issue for additional lighting.

STAPLES, MINN.—F. W. Findsen, city clerk, will receive bids up to 8 p. m., July 26, for the construction of a heating plant as an extension to the municipal lighting plant. A check for ten per cent must accompany the bid. C.

BUTTE, MONT.—The Butte Electric and Power Company is erecting a three-story building, fireproof, with concrete basement, to cost $125,000. Terra cotta will be used in the construction. Link & Haire are the architects who drew the plans. C.

NEENAH, WIS.—It is reported that John I. Beggs, of Milwaukee, will erect a power plant at the Gardner dam to cost $1,000,000, and the power will be carried for sixty-five miles over a series of steel towers, to cities in the Fox River valley. C.

MACON, GA.—The Georgia Southern & Florida Railroad has awarded the contract to the Central Georgia Power Company, of Macon, to supply electric power for the operation of all machinery in its Macon shops. The capacity of shops is to be much increased. B.

ATLANTA, GA.—Referee-in-bankruptcy Adams recently confirmed the sale of the property of Carter & Gillespie Electric Company, to Gate City Electric Company, Atlanta. Much of the stock will be sold and the balance moved to the Gate City Company's warehouse. B.

BROWNTOWN, WIS.—O. D. Curtis, village clerk, will receive bids up to noon, July 31, for the construction of an electric lighting system, consisting of a twenty-horsepower gasoline engine, twelve and one-half-kilowatt generator, belts, poles, wire, etc., estimated to cost $2,800. C.

PASADENA, CAL.—Manager C. W. Koiner of the Municipal Electric Light Company, made a report to the council, which shows the city plant to be in good shape. During the month of May the receipts were $6,505.20, the expenditures $3,474.50, leaving a balance of $3,030.70.

LITTLE ROCK, ARK.—The turbines which have been ordered for the new city electric-light plant will be delivered ready for installation by October 15. The new building will, at that time, be ready for occupancy and the turbines will be put in service in the least possible time.

ATLANTA, GA.—A movement to illuminate a designated route along certain streets through the business heart of Atlanta by installing electric lights every seventy feet is assuming definite shape. A canvass is being made among property owners and tenants, many of whom favor the project. B.

COLLINSVILLE, ILL.—The new Collinsville Electric Light Company has been incorporated for $100,000 and has taken over the assets of the old light company, which is valued at $25,000. The stockholders of the new company are: W. E. Hadley, L. F. Lumaghi, A. W. Crawford, E. B. Hess and J. J. Frey.

PLACERVILLE, CAL.—H. H. Baker has filed an appropriation of 50,000 inches of the waters of the Rubicon River. The water will be diverted at a point on the river about one-fourth of a mile below what is locally known as Grasshopper Bar, where electricity will be generated for the operation of railroads. A.

MONTGOMERY, ALA.—The city has signed a contract with the Montgomery Light and Water Power Company, under which the latter furnishes the necessary electric power for the operation of municipal waterworks. A contract for ten years with the privilege of renewal was given. Gaston Gunter is mayor.

MARTINS FERRY, O.—The city of Martins Ferry has decided to have a municipal lighting plant and will install a 250-kilowatt, 2200-volt, three-phase, sixty-cycle, Allis-Chalmers alternator. When the improvements are completed, Martins Ferry will be one of the best lighted cities of its size in the state.

QUERETARO, MEX.—The Ajuchitlan Mining and Milling Company is erecting a hydroelectric plant near its mines in the Queretaro district. It will provide the mine and reduction mill of the company with 400-horsepower. It is expected that the introduction of this power will greatly cheapen the mining operations of the company. D.

ANOKA, MINN. The water and light commission let the contract to the Allis-Chalmers Company, Milwaukee, for a 250-horsepower compound engine, connected to a 175-kilowatt generator, for $12,000, and to R. B. Whitaker & Company, St. Paul, Minn., for two 150-horsepower water-tube boilers for $8,292. The commission expects to have the new plant in running order by October 1. C.

BROCKPORT, N. Y.—At the electric light station a new powerhouse is to be built in place of the old one, which will be demolished. Everything in the new building will be of the latest design in electric lighting and power. The building is to be 20 feet by 57 feet, containing three large transformers, one for arc lighting, one for incandescent light and one for power. It will be ready for use by September.

CARTERSVILLE, GA.—It is reported that the United States Government will soon construct a big power dam on Coosa River following surveys recently made by government engineers, and that it will furnish power to parties who recently bought the property and power rights at a receiver's sale. The plan is to develop 15,000 horsepower and construct a trolley system from Rome and Cartersville and Canton and other points in Georgia. B.

ARCHBOLD, PA.—The Scranton Electric Company has purchased the Household electric light plant in Jermyn. The Household Electric Light Company was a co-operative concern and was owned by the citizens of Jermyn and Mayfield. The plant will probably be removed and current supplied by the large plant of the Scranton Electric Company in Scranton, which furnishes all the up-valley towns with a day and night service.

EAST TILTON, N. H.—The Stone & Webster Engineering Corporation of Boston, which is acting as consulting engineer for the Laconia Gas Company, has purchased three 250-kilowatt, 6600-volt, three-phase, sixty-cycle alternators from Allis-Chalmers Company. These will be direct connected to hydraulic turbines and will serve as a very important addition to the power supply of the company. Each alternator will be independently excited by a twelve-kilowatt coupled exciter.

WORCESTER, MASS.—The stockholders of the Worcester Electric Light Company met recently and voted to make an application to the gas and electric light commissioners of Massachusetts for authority to issue 2,000 shares of stock in addition to the 8,000 now in force. The increased capital will bring the value of the capitalization up to $1,000,000, as the shares are valued at $100 each. The additional money is to be used in constructing and fitting up the new plant on Webster Street.

DENVER, COL.—The Northern Colorado Power Company has begun setting its poles along the line of the Denver, Laramie & Northwestern Railroad and expects to have its line completed into Milliken by September 1. The company is preparing to spend about $500,000 in installing new lines in this neighborhood and is preparing to supply all towns along the Laramie road with electric light. Laterals will be run across the country to farms and ranches and

electric current will be supplied both for lights and for general farm power purposes.

INDEPENDENCE, MO.—The city council of Independence has decided to issue $15,000 in general revenue bonds to be used in making betterments at the city's municipal electric light plant. This proposition does not have to be submitted to a vote of the people in a bond election. Of this amount, $9,000 will be expended in the purchase of a turbine engine, and the other $6,000 in an addition to the powerhouse and the street lighting system.

CLEVELAND, TENN.—Through a recent real estate deal J. W. Adams and associates, of Chattanooga, become the owners of the Cleveland electric light plant, the consideration being $25,000. The deal is effective August 1. The same company that has purchased this plant is making preparations to build an immense power plant on the Acoll River, near Parksville, Polk County. They have also made surveys for an electric line between Old Fort via Cleveland to Chattanooga. Their purchase of the electric light plant is taken to mean beyond a doubt the final consummation of their plans to build the interurban line.

SAN JOSE, CAL.—The Sierra and San Francisco Power Company, which is supplying power for the operation of the United Railroad in San Francisco, has authorized the issuance of $6,500,000 of first-mortgage five per cent bonds for the purpose of enlarging its plant and so extending its facilities that it may be enabled to supply intending purchasers with all the power required. The bonds are dated August 1, 1909, and are due August 1, 1949. The interest is payable semi-annually. With its several power plants the company already generates about 50,000 kilowatts and this may later be increased to 90,000 horsepower.

CHANUTE, KAN.—The Ash Grove Lime and Portland Cement Company, which has a cement plant here and several lime plants in Missouri, is increasing the capacity of its powerhouse. When the plant was built the company installed four Allis-Chalmers twenty-two by forty-two simple engines. It has recently ordered a forty-six by forty-two low-pressure engine from the same builders, which will serve as a low-pressure side of a cross compound engine of which one of the old engines will serve as the high-pressure side. The new low-pressure engine will be supplied with a rope drive-wheel, duplicate of the one now on high-pressure engine in order to transmit the additional power generated.

SHERBROOKE, CAN.—The Bishop Construction Company, which was awarded the contract for the dam and powerhouse of the Sherbrooke Railway and Power Company, has commenced work here. The three powers owned by the company are located in the center of the city and aggregate a total head of fifty-five feet. The present plan of operations contemplates the development of these powers at one site. A concrete dam will be erected and the water carried by a flume below the bridge on Commercial Street, where the new powerhouse is being erected. The contract for new rails has already been let and the work of reconstructing and extending the street railway will soon be in full progress.

EL PASO, TEX.—The Southwestern Portland Cement Company has recently ordered an eight-inch centrifugal pump direct connected to an induction motor from Allis-Chalmers Company. The installation of this set will be particularly interesting because of local conditions. Power will be transmitted to the motor which will be controlled from the plant about one and one-half miles from the location of the motor. Current is generated at 480 volts and stepped up to 2,200 volts for transmission over an existing line. The motor will operate at about 2,100 volts. The pump will deliver about 2,000 gallons per minute, against a total head of eighty feet, to a reservoir which supplies the plant. A ten-inch riveted steel pipe connects the pump to the reservoir.

GEORGETOWN, CAL.—The powerhouse of the Horseshoe Bar Electric Company at Horseshoe Bend on the middle fork of the American River, five miles east of this town, has been completed and the power turned into the distributing lines. The completion of this powerhouse means that power and light will be furnished to some of the towns and several mines of the county hitherto without power. S. W. Collins and several other citizens of this town are planning to build a line to Georgetown for the purpose of furnishing light and power to the residents. This line may be extended to Greenwood and the Garden Valley district, where many valuable mining properties are awaiting power for their development. It is expected that in the near future the Horseshoe Bar Electric Company will be supplying power to several mines on both sides of the middle fork.

KANSAS CITY, KAN.—A resolution to ascertain the probable cost to the city of acquiring an electric light plant and the feasibility of operating this plant as a municipal enterprise has been passed by the Kansas City (Kan.) commissioners. The electric lights now being used on the Kansas City (Kan.) streets for some time have been furnished by the Kansas City Consolidated Electric Light and Power Company. At the present time there is no money in the light fund of the city to compensate the company for the use of the arc lights and any agreement by the city authorities to pay at some future time would be a violation of the Kansas commission form of government law which prohibits the officials of a municipality from incurring an indebtedness where there is no available money to liquidate it.

ELECTRIC RAILWAYS.

(Special Correspondence.)

IOWA CITY, IA.—The Iowa City Electric Railway Company is about to commence the construction of four miles of road. C.

DOVER, DEL.—The Cincinnati and Pittsburg Electric Railway Company has been incorporated here to build, own, operate and maintain electric and steam railways outside the state of Delaware. The capital at the outset is $1,000,000.

UNIONVILLE, TENN.—A line for an electric road is being surveyed from Franklin to Shelbyville, by way of this place. It is an extension of the Nashville & Franklin road, and if built to Shelbyville will probably be extended to Fayetteville.

GALESBURG, ILL.—Announcement has been made that before the end of October electric cars will be running between Galesburg and Alexis on the Galesburg-Rock Island road. It is said that the roadbed and equipment will be among the best in Illinois.

VILLISCA, IA.—Grading work was recently commenced on the Atlantic, Northern & Southern electric railroad and it is expected that it will be pushed to completion. The start of work on this line is largely due to the efforts of Messrs. Rattenborg, Ross and Judd.

MINNEAPOLIS, MINN.—The Electric Short line, of which Earl D. Luce is president, received its first consignment of rails and expects to have cars running by the end of August. Waiting rooms will be built at Sixth Avenue N. and at the end of the Western Avenue lines. C.

AKRON, O.—Inside of a year the Northern Ohio Traction and Light Company will erect a $2,000,000 powerhouse in this city. This step is made necessary by the growth of the system, to which big branches have been added in the last few years, by purchase and by construction.

PORTLAND, ORE.—The Coos Bay Rapid Transit Company has completed nearly all the preliminary work on the five and one-half miles of electric line between North Bend and Marshfield. The company is incorporated for $1,000,000, of which two-thirds has already been subscribed.

ABERDEEN, S. D.—The Aberdeen Street Car Company has closed a contract with the General Electric Company for two motor-generator sets with switchboard controlling devices. The equipment will be shipped early in September and will be installed before the end of the month.

VINCENNES, IND.—The Federal Construction Company has been organized here, with $25,000 capital stock, to build interurban railroads. The incorporators are: Charles F. Knowlton, of Vincennes, James M. Momemy, of St. Louis, and A. M. Yelton and LeRoy M. Wade, of Vincennes.

OKLAHOMA CITY, OKLA.—An interurban electric line connecting St. Louis with Oklahoma City, Okla., is projected by the McKenna Construction Company, of Oklahoma City. The new company has secured water rights for a power plant at Ada, Okla., and will equip the line with modern sleeper coaches. A lower passenger rate than that of steam roads will be charged.

ATLANTA, GA.—Within a short time active work will begin on the lines of the Atlanta and Carolina Railway, an interurban electric line which, in addition to eight miles of track in this city, will build a line direct to Augusta by way of Athens, also a branch line to College Park, a suburb of Atlanta. Capt. James W. English, of Atlanta, is president of the company, which is capitalized at $6,000,000.

YOUNGSTOWN, O.—A syndicate of Pittsburg and Chicago capitalists has been formed to finance the proposed electric line between Akron and this city and the road now seems assured. The route will include the towns of Tallmadge, Brimfield, Rootstown, Edinburg, Palmyra, Diamond, Milton, North Jackson, West Austinburg. The surveys for the road will be made at once and the work of construction will be started soon.

HANFORD, CAL.—Articles of incorporation have been filed for a company which is to operate electric railways in Kings County. The company is incorporated for $500,000 for a term of fifty years. According to the present plans the road will start in Hanford and run thence through Grangeville to Hardwick and the Summit Lake country, with a branch to Laton. Returning the cars will pass through LeMoore, probably Armona and back to Hanford.

GOLDEN, COL.—Track laying was commenced a short time ago on a new branch of the Denver and Intermountain Electric Line. It connects with the main line at Wyman, two miles south of Golden, and extends to several clay mines south and west of the city. The Morrison and Green Mountain coal mines also will be able to ship their products with convenience over the new line, which it is contemplated will eventually be extended to the town of Morrison.

OAKLAND, CAL.—The Peninsula Railway Company, an allied corporation of the Southern Pacific, which recently received a street railway franchise from the city council, recently began its work under that instrument. Under its franchise the Peninsula Railway Company proposes to operate an electric line over a loop running from the Fourteenth and Franklin Street depot to the Sixteenth Street depot of the Southern Pacific. The lines are to run over Twentieth and Eighteenth Streets.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern Railroad Company will build through Dike to Grundy Center, a distance of twenty-one miles. The company let the contract for the erection of its power house to Jas. Maine & Sons. It will be 154 by 132 feet, with thirty-foot walls, constructed of concrete, steel and brick. Four steam turbine engines, each of 8,000 horsepower, with 6,000-kilowatt dynamos attached, will be installed, together with a steel traveling crane. Cost $500,000. C.

GUTHRIE, OKLA.—The Oklahoma City and Suburban Railway, of which W. A. Haller is president, has filed with the secretary of state a mortgage for $40,000 in favor of the Mississippi Valley Trust Company of St. Louis, on the new lines which it is preparing to build in and around Oklahoma City. The mortgage covers the line from Britton to Edmond, seven miles; from Oklahoma City to Moore, seven miles; one southwest from Oklahoma City through the packing house district and extensions both east and west.

GULER, WASH.—A proposition was made at a recent town meeting to build an electric railway from White Salmon, by way of Trout Lake, crossing the hills east of here, stopping at Glenwood, the plateau country, Snowden and Bristol, and the terminus to be White Salmon. This would make a loop that would place the entire White Salmon Valley on both sides of the White Salmon River in touch with the railway that would tend to increase the shipping facilities of the entire country contiguous to the road. The Trout Lake people favor the road.

PORTLAND, ME.—The Aroostook Valley Railroad between Washburn and Presque Isle was completed and put in operation July 1. The equipment at present consists of one electric locomotive, similar to those used on the Bangor and Aroostook Railroad, and a number of trailers. Power will be supplied from the hydroelectric plant at Aroostook Falls. The present officers of the company are: A. R. Gould, president; H. N. Crandall, treasurer; H. M. Heath (Augusta), clerk; C. F. Daggett, Esq., A. E. Irving, A. R. Gould, of Presque Isle, E. M. Hines, of Washburn, W. B. Gould, of Bangor, directors; C. K. Howard, superintendent.

CHELSEA, MASS.—It is reported that work will be completed on the Boston & Eastern Railroad Tunnel within six months, and the first step taken in revolutionizing the suburban traffic. When completed the road will carry passengers between Boston, Chelsea, Revere, Lynn, Peabody, Danvers and Salem, at a speed of sixty miles an hour. No grade crossings of any kind will be located on the line. Most of the way the line will run overhead or in tunnels. The road will be laid with ninety-pound rails and will maintain a block system. It will be double track all the way, and additional tracks will be added when necessary. Each car will be equipped with four motors apiece, and all cars will be run in trains. Eleven million dollars is the estimated cost of the undertaking, and two and one-half years the time of construction.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

REDFIELD, S. D.—The Redfield Mutual Telephone and Switchboard Association has been incorporated. C.

KERKHOVEN, MINN.—The Kerkhoven-Louriston Telephone Company has been incorporated with a capital of $5,000. P.

RUGBY, N. D.—The county board granted a franchise to the Juniata Telephone Company to construct and maintain telephone lines. C.

NORDHEIM, TEX.—The Eureka Telephone Company has installed a telephone exchange at this place and is rapidly extending its system. D.

MAQUOKETA, IOWA.—The Washington Farmers' Mutual Telephone Company has been incorporated by E. W. Burnett, W. E. Roe and others, with a capital of $2,000. C.

TYLER, TEX.—The Banner Telephone Company has decided to extend its telephone system from this place to neighboring towns and villages and to make extensive improvements of its system within the city. H. E. Scivern, of St. Joseph, Mo., has been placed in charge of the work. D.

MARATHON, TEX.—A telephone line is being erected between Marathon and Terlingua, a distance of ninety miles, by the Chisos Mining Company, whose mines are situated at that place. The poles for the line are laid to Dog Canyon. The stringing of the wires will begin within a short time. D.

LITTLE ROCK, ARK.—The Lake View Telephone Company, of Helena, Philips County, has incorporated with a capital stock of $10,000, all of which has been subscribed. The company will engage in a general telephone business at Helena. The incorporators are: S. Straub, E. M. Allen and others.

LEWISTON, IDA.—Announcement is made by Ray Johnson, district manager for the Pacific States Telephone Company, that $25,000, available at once, has been appropriated by the company for enlarging and improving the system in Lewiston and Clarkston, Wash., and that the work will begin soon.

HARTFORD, CONN.—The Bolton & Coventry Telephone Company has filed a certificate of incorporation. The concern has a capital stock of $2,000 and it will construct and operate a rural telephone line. The incorporators are John Cairnes, of Manchester, Myron W. Main, of Bolton, and Robert W. Pitkin, of Coventry.

PLEASANTON, TEX.—The Bexar-Atascosa Telephone Company has been organized at this place with a capital stock of $3,000 for the purpose of erecting a telephone system between Pleasanton and San Antonio. The company is composed of Pleasanton business men and others living along the proposed line, which will pass through Atascosa and Bexar Counties. D.

DENVER, PA.—The Intercourse Bell Telephone Company has installed a number of new telephones recently. It is quite certain that the capital stock of the company will be increased in order to extend the lines to Bareville, New Holland, Blue Ball and a number of other towns desirous of good telephone service. John M. Beam is president of the company.

SWEETWATER, WASH.— The Webb Ridge Telephone Company, an independent concern was recently organized to construct a rural line from Sweetwater, where it will connect with the Nez Perce Independent Telephone Company's lines into the Craig Mountain country to Snow, Idaho. The following officers were elected: J. A. Ferris, president; Grover C. Pennell, secretary-treasurer, and E. S. Kissinger and E. Perris, directors. The line, which be twenty-five miles in length will accommodate eighteen families.

MEXICO CITY, MEX.—The Mexican Telephone and Telegraph Company is installing a new central station in this city which will double the central battery service of Mexico City. The new office will be of the same capacity as the old one, which has handled the telephone business for about three years. The erection of a new central station has been made necessary by the greatly increased demand for telephone service in the western parts of the city, and especially in the districts occupied by Americans. It is stated that the new office will be placed in operation by January 1, 1911. D.

ELECTRICAL SECURITIES.

That the stock market closed the week with slightly increased prices may be credited chiefly to the unusually good bank statement. This statement showed $16,000,000 in surplus reserves, and while a favorable statement was expected, this large gain was something of a surprise. General business shows improvement. The dry goods trade reports largely increased sales, and there is improvements in steel and iron. The attempt to lower prices through the entire market, by spreading false reports of trouble with Germany over Nicaragua resulted in little damage except to those who tried to take undue advantage of the rumors.

The National Carbon Company's earnings for six months ending July 31, will be at the rate of nearly twelve per cent on the common.

The earnings of the Chicago Railways Company for the first twelve days in July increased nearly fifteen per cent.

The El Paso Electric Railway has applied to the State of Texas for permission to increase its capital stock from $1,500,000 to $2,500,000.

The Charleston (S. C.) Consolidated Railroad, Gas and Electric Company has been given the right to increase its capital stock from $1,500,000 to $2,000,000, by the issue of $500,000 in preferred stock.

An officer of the American Light and Traction Company says that net earnings for June will show about $40,000 increase over last year. This will be at the rate of eighteen per cent, and will bring the rate of increase for the first six months of the year up to over sixteen per cent. The American Light and Traction Company is earning a surplus for its $9,613,300 common stock equivalent to twenty-seven per cent for the year.

Metropolitan Elevated's June traffic averaged 158,000 passengers daily, or an increase of 10,000, while the July increase has been fifty per cent more. A director intimated that an increase in both payable August 13.

Michigan State Telephone Company; regular quarterly dividend of one and one-quarter on its preferred stock and a quarterly dividend of one and three-quarters on its common stock.

Milwaukee Electric Railway and Light Company; regular dividend of one and one-half per cent on the preferred, payable August 1 to stock of record July 20.

Montreal Street Railway; quarterly dividend of two and one-half per cent, payable August 1.

Public Service Investment; quarterly common dividend of one and one-quarter per cent; preferred dividend of one and one-half per cent, both payable August 1.

Quincy Gas, Electric and Heating Company, one per cent, payable July 23.

Sayer Electric Company; regular quarterly six per cent, payable July 15 to holders of record June 30.

Southern California Edison; preferred quarterly dividend of one and one-quarter per cent, payable July 15.

the preferred dividend, recently resumed, will be considered before long unless the merger scheme materializes. Other elevated roads and the surface lines report fair to good increases in this summer's business.

DIVIDENDS.

American District Telegraph of New Jersey; quarterly dividend of one per cent, payable July 28.

American Gas and Electric Company; regular quarterly dividend of one and one-half per cent on the preferred, payable August 1 to stock of record July 21.

Binghamton Light, Heat and Power; regular quarterly six per cent, payable July 15 to holders of record June 30; also a regular quarterly three per cent on common stock, payable to holders of record June 30.

Columbus Railway; preferred quarterly dividend of one and one-quarter per cent, payable August 1.

Commonwealth Edison; quarterly dividend of one and one-half per cent, payable August 1.

Electric Bond and Shore Company; quarterly common dividend of two per cent, payable July 15; quarterly preferred dividend of one and one-quarter per cent, payable August 1.

Grand Rapids Railway Company; regular quarterly one and three-quarters per cent on preferred, payable August 1 to stock of record July 15.

Havana Electric Company; common dividend of one and one-half per cent, and preferred dividend of one and one-half per cent.

NEW YORK.

	July 18.	July 11.
Allis-Chalmers common	8½	8½
Allis-Chalmers preferred	27½	29
Amalgamated Copper	58⅝	60
American Tel. & Cable	*80	*80
Americal Tel. & Tel.	132¼	132½
Brooklyn Rapid Transit	77⅜	75½
General Electric	142	141
Interborough-Metropolitan common	17½	18¼
Interborough-Metropolitan preferred	50¾	50½
Kings County Electric	124	124
Mackay Companies (Postal Telegraph and Cables) common	84	84
Mackay Companies (Postal Telegraph and Cables) preferred	73	73
Manhattan Elevated	126	125¼
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	70¼	70⅝
U. S. Steel preferred	116⅛	114½
Western Union	61	60½
Westinghouse common	58⅞	60
Westinghouse preferred	125	125

*Last price quoted.

BOSTON.

	July 18.	July 11.
American Tel. & Tel.	132¼	132½
Edison Elec. Illuminating	250	250
General Electric	142	141
Massachusetts Electric common	14¾	15
Massachusetts Electric preferred	78	77
New England Telephone	133½	134
Western Tel. & Tel. common	15	15
Western Tel. & Tel. preferred	85	85

PHILADELPHIA.

	July 18.	July 11.
American Railways	42	42
Electric Company of America	11½	11⅝
Electric Storage Battery common	49½	49
Electric Storage Battery preferred	49½	49
Philadelphia Electric	14⅜	14⅝
Philadelphia Rapid Transit	19¼	19¼
Philadelphia Traction	84⅜	84
Union Traction	45½	45½

CHICAGO.

	July 18.	July 11.
Chicago Railways, Series 1	65	65
Chicago Railways, Series 2	15½	15½
Chicago Subway	2	2
Chicago Telephone	117	117
Commonwealth Edison	116	110
Metropolitan Elevated common	18	18
Metropolitan Elevated preferred	60	60
National Carbon common	116	116
National Carbon preferred	118	118

PERSONAL MENTION.

F. C. RANDALL, who has acted as general superintendent of the Galveston Electric Company for a number of years, recently resigned. Mr. Randall's successor has not yet been appointed.

CLARENCE H. MACKAY, accompanied by his wife, sailed for Europe, July 19, on the Kronprinzessen Cecilie. It is their intention to motor through the Black Forest and Holland, returning in about six weeks.

OSCAR T. CROSBY, of Warrenton, Va., was elected president of the Wilmington and Philadelphia Traction Company, which is the result of a recent merger of electric lighting and trolley interests between Washington and Darby, Pa.

JOHN J. CHISHOLM, who was formerly chief engineer of the Waterside station of the New York Edison Company recently resigned his position there. He is now associated with the Westinghouse Electric and Manufacturing Company.

C. T. WILKINSON, of the power and mining department of the General Electric Company, has left this country for a trip of several months to England and France. Mr. Wilkinson will investigate the high-tension power lines in those countries.

C. I. BURKHOLDER was elected president of the Greenville-Carolina Power Company at a recent meeting of the board of directors. Mr. Burkholder is an officer in the Southern Power Company, which recently purchased the Greenville-Carolina Power Company.

JOHN REED, who for the past three years has been manager of the Home Telephone Company, of Weston, O., has accepted a similar position with the Wood County Telephone Company at North Baltimore, O. His place will be filled by W. F. Vantassel, of Roanoke, Va.

SIR J. J. THOMSON, the eminent Cambridge (Eng.) University professor of physics, has been elected president of the Junior Institution of Engineers, of London, Eng., in succession to Sir Henry J. Oram.

CHARLES M. COOK, for many years manager of the Laporte Gas Light Company, of Laporte, Ind., has been made manager of the Laporte Electric Company also. The two companies however, will be conducted separately, though the Childs-Hulswit syndicate of Michigan controls both properties. Mr. Cook succeeds J. H. Harding, who recently sold his holdings to the syndicate.

FRANK JAYNES, general superintendent of the Pacific division of the Western Union Telegraph Company at San Francisco, Cal., retired on July 15, after forty-nine years of active service. He will, however, remain with the company under the title of special agent. C. H. Gaynt, who for several years has been the assistant superintendent and manager of the telegraph office of the Santa Fe Railroad Company at Topeka, Kansas, will succeed Mr. Jaynes.

HENRY B. OTIS has severed his connection with the Sanitary District and has entered the firm of Charles G. Rush & Company, electrical engineers and contractors, with headquarters in Chicago, where he will devote his attention to the power apparatus department. Mr. Otis has been identified with the electrical industry in Chicago since 1899, when he started in the dynamo testing room of the Western Electric Company. He left them in 1905 to become Chicago manager of the Cutter Company of Philadelphia, and recently went with the Sanitary District. The best wishes of his large acquaintance in the electrical industry go to Mr. Otis in his new undertaking.

J. F. JONES has been appointed by the Wagner Electric Manufacturing Company of Saint Louis to open an office for them at Birmingham, Ala., and the Woodward Building in that city has been selected as the home for this new office. Mr. Jones, who is a Southerner, was born in Gainesville, Ala. He graduated in 1901 from the Alabama Polytechnic Institution, and then entered the employ of the General Electric Company, progressing through the testing department, inspection department, and finally becoming a specialist in transformer sales. In 1905 Mr. Jones left Schenectady to become transformer sales engineer for the Fort Wayne Electric Works. In February, 1909, he resigned from the Fort Wayne Electric Works and joined the home office force of the Wagner Electric Manufacturing Company at Saint Louis. Demonstrating his efficiency with the Wagner Company and because of his large circle of friends in and about Birmingham, he has been placed in charge of the new Birmingham office as above outlined.

SYLVESTER S. HOWELL has become associated with Paul M. Chamberlain, engineer, Marquette Building, Chicago, forming a firm which, under the name of Chamberlain & Howell, will carry on the designing and consulting engineering practice established by Mr. Chamberlain. Mr. Howell's many friends will welcome this move as giving wider latitude for his talents and varied experience. Mr. Howell received his collegiate education at the Iowa State College, and since 1887 has given his attention to engineering matters. His experience involves work with a number of firms, among which are the following: The old Thomson-Houston Company, in installation; the Westinghouse Electric and Manufacturing Company in its great installation at the World's Fair in Chicago; the Standard Oil Company of Indiana in electric lighting plant installations; the Patton Motor Company; the Green Fuel Economizer Company; the Holtzer-Cabot Electric Company; the Carbolite Gas and Iron Company of Hammond; the Calumet Portland Cement Company of Chicago; the American Blower Company, and several other well-known concerns.

L. R. POMEROY has been appointed chief engineer of the railway and industrial division of J. G. White & Company, Incorporated, with headquarters in New York city. Mr. Pomeroy has for a long time been considered an authority on railway shop equipment, operation and construction, and is peculiarly adapted both by nature and training for his new work. From 1874 to 1880 he was engaged in commercial business, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this, he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly. This assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for all railway purposes. For the past two years he has been assistant to the president of the Safety Car Heating and Lighting Company. In these lines of work he has devoted a large portion of his time to consulting work in the special field of railway shops, machine tool operation and the adaption of tools to the work, with special reference to sequence of operation and general efficiency and his special attainments and experience form a valuable addition to the J. G. White & Company organization.

J. C. MURRAY, sales engineer for the Kellogg Switchboard and Supply Company, has left on a six months' business extension trip in South America. Mr. Murray expects to visit Kellogg Company, customers, agents and friends in all the more important cities, stopping at Bahia, Rio de Janiero, Sao, Paulo, Montevideo, Buenos Ayres, Santiago, Lima, Colon and other cities. Mr. Murray is a practical telephone man of long experience and is at the service of operating companies for information, specification, etc. This trip will widen the already favorable opinion in which Kellogg telephones and switchboards are held in South America, as a result of their unequalled service record in actual operating. Mr. Murray has with him complete apparatus, samples and literature, including the Kellogg Company Spanish bulletin, which describes in Spanish and illustrates clearly the various types of apparatus. He will push the sale of Kellogg railroad telephones and despatching systems, mining telephones and special equipment.

J. C. MURRAY.

OBITUARY.

ALOIS WIRSCHING, the inventor of the stock-quotation telegraph ticker, who also installed the present fire alarm system in Manhattan, died July 14, in his seventy-ninth year at his home, 188 South Eighth Street, Williamsburg, N. Y. He was born in Vienna, Austria, and came to America when he was seventeen years old. He was a charter member of the Canarsie Yacht Club and built the first racing catboat to sail in Jamaica Bay.

E. H. LINCOLN, until recently assistant general manager of the Philadelphia Rapid Transit Company, was instantly killed while attempting to board a Washington train at the West Philadelphia station of the Pennsylvania Railroad, July 11. Mr. Lincoln resigned his position with the street railway company to become associated with the Goldschmidt-Pherim Company, metal manufacturers, of New York. He was one of the original promoters of the Pay-Within Car Company and at the time of his death was vice-president of the Electric Service Supplies Company of Philadelphia.

DR. MIHRAN K. KASSABIAN, one of the best known X-ray specialists in the United States, died recently at a hospital in Philadelphia from skin cancer contracted from burns received during many years of practice with Roentgen rays. Dr. Kassabian was born in Asia Minor in 1868. He was graduated from the Missionary School of Athens, and in 1894 he came to this country. He entered the Medico-Chirurgical Medical College and was graduated from that institution in 1898. In 1907 Dr. Kassabian published a book on electro-therapeutics, which has been a standard work.

ROBERT IRWIN, aged eighty-seven years, for whom Andrew Carnegie worked more than half a century ago as a telegraph messenger boy, died Saturday, July 9, in Pittsburg. Mr. Irwin encouraged young Carnegie and directed his ideas into the channel of bettering his position by learning telegraphy. Mr. Irwin was born in County Monaghan, Ireland, and served five years in the constabulary before coming to the United States. He settled in Pittsburg sixty years ago, and was the first chief of police of Allegheny City. He then worked for the Pennsylvania Railroad and later served as a police lieutenant.

JOHN DENISON EVARTS DUNCAN died at Ann Arbor, Mich., on July 13, at the home of his mother, Mrs. Martha Duncan. Mr. Duncan had been continuously associated with Sanderson & Porter, engineers and contractors, since February, 1901, and had acted as managing engineer of their New York office for the last six years. He was born at Union Falls, Clinton County, N. Y., in July, 1871, and, with his parents, moved to Ann Arbor, in 1879. He attended the high school at Ann Arbor, then entered the University of Michigan and was graduated from the School of Engineering in 1893. The following year was spent in post-graduate work at Cornell University, from which he received the Master's Degree in 1894. From 1894 to 1896 Mr. Duncan was employed by the Terre Haute Street Railway Company and the Stanley Electric Manufacturing Company, of Pittsfield, Mass. On leaving the Stanley Electric Manufacturing Company, Mr. Duncan successively held engineering positions with the Metropolitan Street Railway Company; Western Electric Company; New York Telephone Company; Westinghouse, Church, Kerr & Company; and Consolidated Railway Electric Lighting & Equipment Company. On his return from a trip to Alaska on engineering work connected with a mining enterprise, Mr. Duncan entered the employ of Sanderson & Porter, New York city. While directing the engineering work of this firm, Mr. Duncan had been in responsible charge of the design and execution of many large and diversified engineering projects and had well earned the high esteem and confidence of his employers, associates and friends in engineering and business circles. Mr. Duncan was a life member of the American Society of Mechanical Engineers, a member of the American Institute of Electrical Engineers, the Brooklyn Engineers' Club, the Engineers' Club of New York, the Machinery Club of the City of New York, the Masons, the Michigan Club of New York, the University of Michigan Club, and the Cornell University Club. In 1901, Mr. Duncan married Miss Lena Hill, of Lyons, N. Y., who, with his mother and two brothers, survives him.

LEGAL NOTES.

WHAT REGARD MUST BE HAD FOR THE SAFETY OF CHILDREN.—After quoting from decisions of courts in the various parts of the country, the supreme court of Vermont says, in Wetherby vs. Twin State Gas and Electric Company, 75 Atl., R. 8, that they indicate with substantial unanimity, either affirmatively or negatively, either by inclusion or exclusion, a rule at once just, humane, and practical, resulting from the application of long-settled principles to the now existing necessity for the distribution and use of the dangerous substance, electricity. The business of transmitting electricity, while indispensable to society, must be conducted with a high regard for the safety of the public, and the thoughtlessness, inexperience, lack of judgment, and misjudgment of children of tender years must be taken into account; but the courts cannot make electric companies insurers of the safety of children, more than others, nor require of such companies in the circumstances of their business, a degree of care, prudence, and foresight beyond that which it is given to careful and prudent men to have and exercise in such or like circumstances.

BULLETINING OF TRAINS BY USE OF TELEPHONE APPROVED.—The supreme court of Oklahoma holds, in St. Louis & San Francisco Railroad Company vs. Newell, 106 Pac. R. 818, that an order of the corporation commission, requiring a railroad to install telegraph service at one of its stations for the sole purpose of bulletining its passenger trains, made without any findings of fact or evidence as to the extent of the passenger traffic at said station, or the amount or approximate amount of the receipts therefrom, was error, where it was shown that such additional service would require an increase in the expense of the company for maintenance of the station of from 75 to 100 per cent. But, the company being willing to bulletin its trains if it could do so without incurring the great expense necessarily incident to telegraphic service, and suggesting that it would not object to the order if it required only that it bulletin its trains, whether by telegraph or telephone, the court says that if the company can bulletin its trains by the use of the telephone as effectively as by the use of the telegraph, and can do so at a less expense, no good reason appears why it should not be permitted to use that method. The thing primarily desired is information to the public as to the arrival of the trains. If this can be as effectually accomplished by a method cheaper than the one proposed in the order, and the difference in expense of such method will enable it to be done without imposing any unreasonable and unjust burden upon the company, or upon the general patronizing public, who in the end must pay the expenses of operating the railway, the order should be made for such service by such cheaper means.

PROPOSALS.

POSTOFFICE, WOBURN, MASS.—The office of the Supervising Architect, Washington, D. C., will receive bids until August 9, for the construction, complete, (including plumbing, gas fitting, heating apparatus, electric conduits and wiring of the United States Post Office at Woburn, Mass., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Woburn, Mass., or at the Supervising Architect's office.

POST OFFICE, CARBONDALE, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until August 22 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Carbondale, Pa., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Carbondale, Pa., or at the Supervising Architect's office.

POST OFFICE, PONTIAC, MICH.—The office of the supervising architect, Washington, D. C., will receive sealed bids until August 18 for the construction complete (including plumbing, gas piping, heating apparatus and electric conduits and wiring) of the United States post office at Pontiac, Mich., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Pontiac, Mich., or at the supervising architect's office.

POST OFFICE, PALESTINE, TEX.—The office of the Supervising Architect, Washington, D. C., will receive bids until August 19, for the construction, complete, (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Palestine, Texas, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Palestine, Tex., or at the Supervising Architect's office.

NEW INCORPORATIONS.

DUNKIRK, N. Y.—The Dunkirk Electrical Manufacturing Company has been incorporated with a capital of $100,000 to manufacture and deal in electrical fixtures, etc. The incorporators are A. W. Cummings, H. T. Litchfield and O. B. Mulholland, of Dunkirk.

ALBANY, GA.—The Albany Electrical Supply Company has been incorporated by L. Lewenstein, S. Forkas and R. Lewenstein, with a capital of $2,500. This company, which is a re-organization of the Albany Engineering Company will handle wholesale electrical supplies and will equip buildings etc. B.

NEW PUBLICATIONS.

APPLICATIONS INDUSTRIELLE DE L'ELECTRICITE.—In this book, by L. Creplet, are presented the lectures which were delivered by him in 1907 before the Association of Engineers of the School of Liege. The author does not go deeply into the purely mathematical side of the question, but explains the electrical phenomena by likening them to familiar facts. The book is intended not only for engineers who possess special knowledge of electricity, but to all technical men who are using electrical power.

PORTLAND ELECTRIC-BUILDING SOUVENIR.—The Portland Railway, Light and Power Company has published a very interesting booklet as a souvenir of the opening of the Electric Building in Portland, Ore. The building which the booklet describes was constructed around a substation while all the apparatus continued to run without interruption. Mention is made of the fact that, although the substation was undermined and the machinery supported by timbering, there were no serious accidents caused by any one coming in contact with the electrical apparatus. Illustrations showing the building, its illumination scheme, and a number of the offices add considerable interest to the publication.

INDEX TO PROCEEDINGS.—The National Electric Light Association has just issued, in a limited edition of 1,000 copies, a complete cross-reference index to the reports of all the Conventions from 1885 to 1909, inclusive. This edition is being distributed to all the member companies down to 1909, and to the officers of the association who filled executive positions during the period. This plan leaves a few copies on hand for general distribution, in response to inquiries from libraries and other institutions that may happen to have a full set of the Proceedings. It is obvious that the index is of little direct use to those who are without a full set of the Proceedings to which the index makes reference; while to the fortunate possessors of a set the index is a key to a vast accumulation of immensely valuable data. The book is uniform in size and binding with the Proceedings, and fills 243 pages. It includes a general index; a list of twenty-four classes into which the topics are divided; an excellent synopsis of papers and discussions; an authors' index, and a title index.

INDUSTRIAL ITEMS.

THE PACIFIC STATES ELECTRIC COMPANY announces that it has opened an office and store at No. 90-92 Seventh Street, Portland, Ore. The company will carry a complete stock of electrical supplies, instruments and apparatus at this store.

THE J. LANG ELECTRIC COMPANY, Chicago, Ill., has issued its general catalogue No. 810 cancelling all previous catalogues. A complete line of switches, fuses, switchboards, accessories, etc., is presented with numerous illustrations. Prices are given throughout.

THE ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., recently published bulletin No. 105 illustrating its alternating current generators. As a supplement to the bulletin are attached three illustrations of machinery, which the company built and installed for the Peerless Electric Company, of Warren, Ohio.

THE MINNEAPOLIS STEEL & MACHINERY COMPANY, Minneapolis, Minn., has listed, in its monthly stock list for July, an exceptionally large stock of transmission machinery. The company calls attention to the fact that only a portion of the stock is listed in this monthly publication, and that the complete line may be obtained from the catalogue.

THE C. W. HUNT COMPANY, New York, N. Y., builders of coal handling, conveying and hoisting machinery, announces that arrangements have been made by which their business on the Pacific Coast will be handled by the San Francisco Bridge Company, with offices at 865 Monadnock Building, San Francisco. The company has just completed a Naval Coaling Station in San Francisco Bay for the government.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces the removal of its Charlotte, N. C., office to the Woodward Building, Birmingham, Alabama, to be in charge of J. F. Jones. The Birmingham office will cover that part of Tennessee east of the Tennessee River, and all of the states of Mississippi, Alabama, Georgia and Florida. North and South Carolina which have heretofore been handled from the Charlotte office will now be handled from the Philadelphia office, which is located in the Real Estate Trust Building, and is in charge of John Mustard.

THE UNIVERSAL SPECIALTY COMPANY, Terre Haute, Ind., is distributing a folder containing some new suggestions on the methods of constructing telephone drop circuits. Special mention is made of the desirability of such an insulator as the "Universal" on lines employing twisted-pair wire. This insulator affords, among other things, a high and permanent insulation by having a separate groove for each wire of the pair. There can be no chance of the wires rubbing at the insulator. An interesting feature of this folder is a series of illustrations which show how the insulator may be used under different conditions.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., recently sold a turbine for a particularly interesting installation to the Standard American Dredging Company, of San Francisco. This company is one of the largest dredging concerns in the United States and has many boats on the Pacific Coast and on the Gulf. The turbine, which is a standard 500-kilowatt, 2,300-volt, three-phase, sixty-cycle, 3,600-revolutions-per-minute machine, will be installed on one of its largest dredges and will furnish power for driving a 500-horsepower motor direct-connected to the dredge pump. The alternator will receive exciting current from a fifteen-kilowatt Allis-Chalmers generator direct-connected to an American Blower Company's engine.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY, of Niagara Falls, N. Y., has arranged to erect a very substantial and large addition to its works on the lands of the Niagara Falls Power Company in that city. The addition will be in the nature of a furnace room, which will afford capacity for ten or twelve new furnaces. The buildings will be of brick and steel construction and erected to the west of its present works, where there is ample room for still further enlargement. The additional furnaces will make possible a very large increase in the output of Acheson-Graphite, and is indicative of the constantly increasing recognition of the value of the products of the company. These products are electrodes for electrochemical, metallurgical and electrical purposes, and powdered graphite for dry-cell filler, paint pigment, powder glazing, lead pencils, firearms lubrication, general lubrication, electrotypers' moulding and polishing leads, etc.

DATES AHEAD.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 26, 27 and 28.

Society of Automobile Engineers. Next meeting, Detroit, Mich., July 28, 29, 30.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Electrical Exposition. San Francisco, Cal., August 20 to August 27, 1910.

International Association of Municipal Electricians. Annual convention, Rochester, N. Y., September 6, 7, 8 and 9.

Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps. Twenty-ninth annual reunion, Chicago, Ill., September 8-10.

Pennsylvania Electric Association Convention, Glen Summit Springs, Pa., September 14-16.

New England Section, National Electric Light Association, Fall convention, Pleasant Point, New London, Conn., September 13 and 14.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Col., September 21, 22 and 23.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Kansas City, Kan., September 27-28.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

American Society of Municipal Improvements. Annual convention, Erie, Pa., October 11-14.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 12, 1910.

963,735. ELECTRIC SWITCHING DEVICE. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Filed April 10, 1908. There are two movable contact-bearing switch-arms rotatably mounted to move parallel to the face of an insulating plate or slab; a single means normally holds both switch arms in closed circuit position; and another means causes this single means to move the one or the other of the switch-arms to open position.

963,736. ELECTRIC-ARC LAMP. Thomas Edgar Adams, Cleveland, Ohio, assignor to The Adams-Bagnall Electric Company, Cleveland, Ohio, assignor to The Adams-Bagnall Electric Company, Cleveland, Ohio. Filed July 14, 1909. A blade secured to an electrode comprises members parallel with the axis of the electrode, and projections spaced apart and connecting these members.

963,745. PROCESS OF MAKING INCANDESCENT-ELECTRIC-LAMP FILAMENTS. Walter G. Clark, New York, N. Y., assignor to Parker-Clark Electric Company, Jersey City, N. J. Filed April 5, 1906. The process consists in flashing a filament in an atmosphere containing a hydrocarbon gas, a silicon chloride and an absorbent for the chlorine freed by the flashing process and the admission of oxygen to the atmosphere.

963,755. MOTOR-SADDLE. Hugo W. Forslund, Chicago, Ill., assignor to J. W. Reedy Elevator Manufacturing Co., Chicago, Ill. Filed Dec. 14, 1906. The saddle is devised to hold the motor case in such a position that the shaft will be always in alinement with its bearings.

963,762. PROTECTIVE DEVICE FOR ELECTRIC APPARATUS. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. A circuit interrupter.

963,763. ELECTRIC THERMOSTAT. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. A thermostat comprises a centrally supported spiral of resilient conducting materials which is movable responsive to the combined actions of the heat and the magnetic flux produced by currents flowing through it, and a magnetizable frame constituting both a support and a partial circuit for the magnetic flux produced by the currents which traverse the spiral.

963,764. ELECTRIC CIRCUIT INTERRUPTER. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed May 6, 1907. Includes the electric themostat described in the preceding.

963,781. OUTLET-BOX. Louie T. La Paugh, Utica, N. Y. Filed Nov. 22, 1907. The outlet box has a top with flaps cut therein and turned up to form opposite walls of a casing, blanks cut to fit the flaps in forming the other opposite walls of the casing, the flaps and members having lugs and recesses interfitting in the uniting of the same.

963,802. OUTLET-BOX. George E. Neuberth, Newark, N. J. Filed May 13, 1909. The outlet box comprises a series of members detachably secured together, a cover consisting of end members and side strips detachably secured together, means for securing switches to the cover, and means for securing the cover to the body portion so that it can be tilted and fastened in its different tilted positions.

963,809. PROTECTIVE DEVICE FOR ELECTRODES. Theodor Sahrig, Berlin, Germany, assignor to General Electric Company. Filed Sept. 25, 1906. A protecting device for aluminum electrodes of electrolytic cells, consists of a protective covering extending below the fluid level and composed of rigid material adapted to resist the chemical effect of the electrolyte, the covering being secured to the part to be protected by a cement consisting of plastic mineral substances.

963,817. DIPPING MECHANISM FOR ELECTROPLATING APPARATUS. John H. Shaw, New Haven, Conn., assignor to Sargent & Company, New Haven, Conn. Filed May 3, 1909. A rotary member is adapted to travel above a bath and to be intermittently rotated, and a work-holder is raised or lowered upon the rotation of this member.

963,825. LIMIT-SWITCH FOR MOTOR-OPERATED DEVICES. Haifdan A. Steen, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed Dec. 2, 1909. An electric-circuit switching-device comprises a stationary shaft, a sleeve rotatable thereon, a plurality of contact fingers secured to and insulated from the sleeve, a spring tending to rotate the sleeve in one direction, and a latch for holding the sleeve in opposition to the spring.

963,830. LIGHTNING-ROD CONSTRUCTION. Thomas Thompson, Burlington, Iowa. Filed April 20, 1910. A tubular member is disposed at an angle and connected by a coupling to a conductor, and tubular braces are secured at their upper ends to the tubular member and provided at their lower ends with integral ears embracing the conductor and securing the braces thereto.

963,846. INSULATED JOINT. Gilbert Wright, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 2, 1910. An insulating joint comprises two nipples having square flanges, an interposed quarterfoil sheet of insulating material, and lobes on a flange folded over upon the other flange and upon the corresponding lobes of the insulating sheet.

963,849. OSCILLATING FAN. Ralph E. Barker, Lynn, Mass., assignor to General Electric Company. Filed Nov. 29, 1902. Automatically actuated means periodically stop the flow of the air currents through a portion only of the space traversed by the air currents.

963,852. GALVANIC BATTERY. Stephan Benko, Budapest, Austria-Hungary, assignor to Company Limited of Exploitation of Inventions by Stephan Benko, Budapest, Austria-Hungary. Filed Jan. 19, 1909. A method of operating galvanic elements comprises passing the electrolyte, containing a depolarizing gas, through the pores of the negative electrode, by creating alternately a higher and a lower pressure on one side of the electrode.

963,859. CIRCUIT-BREAKER. Eastman A. Burrows, Chicago, Ill., and Frederick P. McIntosh, Elkhart, Ind., assignors to General Electric Company. Filed April 9, 1906. Operating means comprise a solenoid having alternate windings, a switch controlling a normally open circuit for the solenoid, a plunger connected to the circuit breaker and adopted to be moved in a direction to close the same by the energization of one of the windings and in a reverse direction by the energization of the other of the windings, and means automatically operated after each successive actuation of the plunger to shift the solenoid circuit from one of the windings to the other.

963,865. PANTOGRAPH-TROLLEY. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 25, 1909. A pantograph trolley has its traveling contact capable of vibratory movement independent of the pantographic structure, and a single set of springs operating to raise the trolley and also to maintain the contact yieldingly in a normal position.

963,867. ELECTRIC-CONTROL SYSTEM. William M. Chubb, San Francisco, Cal. Filed July 12, 1909. The system includes a divided circuit, a resistance in each circuit, points of equal potential on the resistances, contacts on these points, a conductor connecting the contacts and electromagnetic means in the conductor operated by the movement of one contact to a point of different potential to cause a solenoid to be energized. An iron core in the solenoid is connected with the other contact point and adapted to be moved by the solenoid to cause the contact point to move to a point of like potential.

963,875. TELEPHONE SYSTEM. William W. Dean, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. Filed April 2, 1910. There is a link conductor at the exchange for connecting the lines together in conversational relation, and a switch associated with this link conductor controls the connection of a source of signaling current at the exchange with a called line. A relay is associated with the link conductor and a shunt about the switch is controlled by said relay.

963,879. JUNCTION-BOX. Jenesse R. Duff, New York, N. Y., assignor to General Electric Company. Filed Nov. 13, 1906. A junction box has a ring C and terminal lugs P adapted to be fastened thereon, the lugs having at their ends sockets V to receive the ends of cables, and an opening U above the socket for applying solder.

963,892. ELECTRIC HEATER. Caryl D. Haskins, Schenectady, N. Y., assignor to General Electric Company. Filed June 23, 1909. An electric heater has a heating surface composed of a material which is softened by the heat developed in the heater and a body to be heated arranged to sink into the softened material.

963,897. TIME-LIMIT RELAY. Ernest H. Jacobs, Schenectady, N. Y., assignor to General Electric Company. Filed Feb. 23, 1909. In combination with a tripping member and an electroresponsive device having an armature arranged to actuate the tripping member when moved, is a retarding device for retarding the movement of the armature; a toggle nomally overset forms a rigid connection between the armature and the retarding device, and means are provided whereby the toggle is collapsed at a predetermined point in the travel of the armature and the armature is thereby freed from restraint.

963,907. ELECTROMAGNET-COIL. Charles B. Larzelere, Schenectady, N. Y., assignor to General Electric Company. Filed March 29, 1909. A current-carrying coil for an electromagnetically controlled device comprises a rectangular bar of conducting material having a transverse hole therethrough and intersecting slots forming the material of the bar into a loop around the hole.

963,908. RECORDING-PYROMETER OF THE THERMO-ELECTRIC TYPE. Walker De H. Lee, Cleveland, Ohio. Filed Nov. 25, 1908. Comprises a galvanometer and a base therefor, a graduated scale, operatively attached to the base, and an indicator hand in connection with the galvanometer, one end of which is adapted to pass under the graduated scale; a second graduated scale is permanently attached to the base, the other end of the indicator hand passing over the last mentioned scale, and means are provided whereby the armatures of a pair of solenoids are operatively related and connected to actuate the scale to depress the hand.

963,934. DEVICE TO BE USED AS TELEPHONE-RECEIVER. Karel Ort, Kostice on Eger, Josef Rieger, Domausice, near Louny, and Josef Karel Ort, Kostice on Eger, Austria-Hungary. Filed Nov. 29, 1907. The device consists of superposed diaphragms of conducting materials, alternate layers of the same being connected together in one series to form a continuous conductor and connected to the positive pole of an electric circuit, and the remaining alternate layers being connected in a second series and connected to the negative pole of the circuit, a layer of elastic dielectric material interposed between each two conducting diaphragms, and means for elastically suspending the whole.

963,942. ELECTRICAL DRYING APPARATUS. George W. Richardson, Philadelphia, Pa., assignor of one-half to Stephen T. Major, Pencoyd, Pa. Filed June 1, 1908. Rollers are heated by internal electric coils.

963,954. TELEPHONE-RECEIVER. Sol. S. Sonneborn, New York, N. Y. Filed May 18, 1908. A telephone receiver comprises a permanent magnet having a plurality of poles, a plurality of diaphragms co-operating therewith, a casing having a single earpiece orifice, and a cup-shaped part having perforations

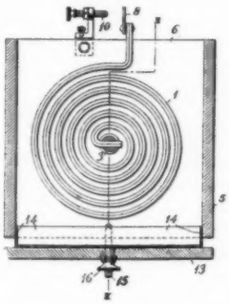
whereby the sound vibrations from all of the diaphragms are combined to issue through the orifice.

963,980. APPARATUS FOR THERMOCHEMICAL GENERATION OF ELECTRICITY. Lucien Paul Basset, Paris, France, assignor to Maurice Bacqua de Labarthe, Paris, France. Original application filed March 27, 1906. Divided and this application filed Feb. 20, 1908. Renewed April 19, 1910. A thermochemical generator of electricity comprises a vessel separated into compartments by walls of carbon and walls of porous material alternately disposed, the compartments forming two groups the elements of which are connected with each other alternately, and means for passing two different electrolytes through these two groups of compartments, the walls of carbon constituting also insoluble electrodes.

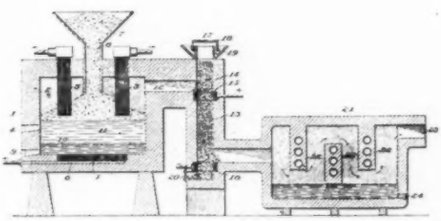
963,996. ELECTRIC SWITCH. John L. Creveling, New York, N. Y., assignor to Safety Car Heating and Lighting Company. Filed May 28, 1908. An electromagnetic switch.

964,007. IGNITION APPARATUS. Arthur E. England, Boston, Mass., assignor to Arthur A. Maxwell, trustee, Worcester, Mass. Filed May 22, 1907. A combined spark plug and induction coil, etc.

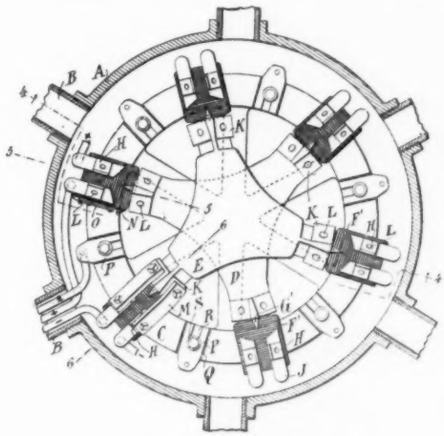
964,015. ELECTRICITY-MEASURING INSTRUMENT. Johannes Gorner, Eschersheim, near Frankfort-on-the-Main, Germany, assignor to the firm of Hartmann & Braun, Aktiengesellschaft, Bockenheim, Frankfort-on-the-Main, Germany. Filed Aug. 31, 1906. An electric measuring instrument for use in alternating circuits, includes a shunt electromagnet, comprising an iron core divided into independent sections, each of the sections being closed in itself by a magnetic limb, part of the magnetic limbs being broken by an air gap and embraced by a series coil co-operating with the shunt electromagnet to produce a shifting magnetic field, an element extending into the air gap and adapted to be acted upon by the shifting magnetic field.



963,763.—ELECTRIC THERMOSTAT.



964,268.—APPARATUS FOR SMELTING ORES.



963,879.—JUNCTION BOX.

964,016. ELECTRIC-LAMP-SHADE HOLDER. George Habig, Los Angeles, Cal. Filed Nov. 13, 1909. The holder comprises a shade ring provided with a keeper, a clamping ring carried by the shade ring, having the terminals thereof reduced and adapted to reciprocate in the keeper, and pivotal means whereby the terminals may be retained in a contracted position.

964,028. SPARK-PLUG. Irwin Floyd Kepler, Akron, Ohio. Filed Dec. 10, 1908, Serial No. 466,866. Renewed Nov. 26, 1909. A spark plug comprises a tubular body portion, an insulated binding pin arranged in this, a terminal fastening cap arranged on the outer end of the plug, the cap comprising inner and outer adjustable connected sections, a clamping plate forming the outer end of the cap, and a spring to hold the clamping plate in engagement with the terminal of an electric conductor whereby the terminal is secured in electric contract with the end of the binding pin.

964,033. GENERATOR APPARATUS. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Co., Genoa, Ill. Filed June 19, 1908. A magneto generator.

964,037. CONTROLLING MEANS FOR ELECTRIC CIRCUITS. Julius K. Lux, Jersey City, N. J. Filed Sept. 2, 1909. A snap switch.

964,057. WINDOW-LIGHTER. Andrew J. Sanford, Newark, Ohio, assignor to The A. H. Heisey & Co. Inc., Newark, Ohio. Filed Oct. 15, 1909. An oblong integral glass shade is provided with a plurality of necks for attachment to a holder, each neck being adapted to carry an incandescent bulb.

964,058. WINDOW-LIGHTER. Andrew J. Sanford, Newark, Ohio, assignor to The A. H. Heisey & Co., Inc., Newark, Ohio. Filed Oct. 15, 1909. A window lighter consits of a plurality of sections each provided with interior transverse walls and means for supporting the sections.

964,086. FIRE-ALARM SYSTEM. William Carroll, Chicago, Ill. Filed Feb. 11, 1909. Describes the electric circuit connections.

964,096. PROCESS OF ELECTROPLATING. Thomas A. Edison, Llewellyn Park, Orange, N. J. Filed March 19, 1906. The process consists in halogenizing a suitable quantity of copper sulphate solution, and adding from time to time in small amounts to the solution in a copperplating bath, as the halogen becomes exhausted by reaction with the hydrogen developed upon the cathode.

964,125. APPARATUS FOR CLEARING ICE AND SNOW FROM THIRD RAILS OF ELECTRIC RAILWAYS. Alois J. Simon, Chicago, Ill. Filed Oct. 25, 1909. The apparatus consists of a pair of ice-breaking wheels traveling on the third rail and each adapted to break up and loosen the ice or snow thereon, a rotating brush between the wheels adapted to remove the loosened ice or snow, and a frame to which the wheels and brush are journaled and by which they are attached to the truck of a car.

964,145. MICROPHONIC TRANSMITTER. Charles Logan Chisholm, Marysville, New Brunswick, Canada, assignor of one-sixteenth to Charles Sadler, Edmonton, Canada. Filed Aug. 5, 1908. The instrument has a carbon diaphragm metal-plated on its peripheral edge, and a support for the diaphragm to which it is united by a metallic cement.

964,169. CURRENT-INTERRUPTING DEVICE. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Co., Genoa, Ill. Filed June 19, 1908. A current modifier comprises a fluctuating-current generator, an induction coil having a primary winding, a secondary winding, a contact-breaking device, an armature for controlling the contact-breaking device, the armature being under the inductive influence of both windings, and the generator, primary winding and contact-breaking device constituting a serial metallic circuit, the secondary winding being adapted for connection to a transmission circuit, means controlled by the generator for short-circuiting the secondary winding when the generator is not operating, and a condenser around the contact-breaking device.

964,197. PORTABLE ELECTRICAL TOOL. Frank J. Backscheider, Cincinnati, Ohio. Filed Feb. 8, 1909. In combination with a driving shaft and a driven shaft, is a yieldably mounted intermediate power transmission; a switch controls the current actuated in disconnecting by the movement of the yieldably mounted transmitter around the axis of the member with which it engages.

964,214. TELEPHONE-TRANSMITTER. Charles L. Chisholm, Marysville, New Brunswick, Canada. Original application filed Jan. 20, 1909. Divided and this application filed March 9, 1909. A microphonic transmitter has a diaphragm for receiving the direct impact of sound waves, the diaphragm being superficially unobstructed on its sound-receiving face, and having a fundamental rate of vibration higher than the rate of vibration of the normal voice waves to be transmitted and a granule chamber substantially coextensive with the diaphragm.

964,268. APPARATUS FOR SMELTING ORES YIELDING A VOLATILE METAL. Woolsey McA. Johnson, Hartford, Conn., assignor to The Continuous Zinc Furnace Company, Hartford, Conn. Filed Nov. 9, 1906. Apparatus for smelting ores yielding a volatile metal, comprises an electric smelting furnace, a porous body of carbonaceous materials, a condenser, and electrodes disposed in contact with the body of carbonaceous material.

964,274. ELECTRIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS. John F. Kelly, Pittsfield, Mass. Filed Sept. 14, 1907. In combination with tone producing devices of the instruments, are electromagnets for operating the tone-producing devices, means for varying the magnetomotive force of the magnets and the loudness of the tones produced by the operation of the magnets by changing the number of turns of the magnet windings through which the energizing current flows.

964,281. ELECTRIC-LAMP-HOLDING SOCKET. Harry Wallace Lawrence, Denver, Colo. Filed July 16, 1909. Includes a switch and a shock-absorbing device.

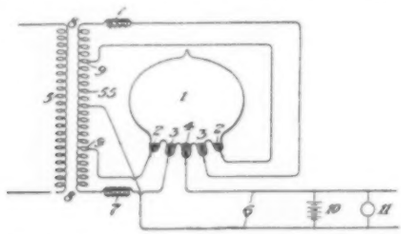
964,289. ELECTRIC TIME-SWITCH. John De Lorenzo, Linhart, Pa. Filed Jan. 3, 1910. A latch is released by an electrically operated time-controlled device.

964,297. LIGHTNING-ROD UPRIGHT. George J. Moore, Maryville, Mo. Filed Feb. 10, 1910. The upright has its lower end portion provided with a loop to receive the rod and its upper end tapered to provide a point.

964,298. DEVICE FOR TIMING MAGNETOS TO OPERATE WITH TWO-CYLINDER GAS-ENGINES SET V-SHAPED. Theodore M. Mueller, Braintree, Mass. Filed Oct. 12, 1907. In combination with a magneto and its armature shaft and a gas-engine having V-set cylinders, are a driving gear, yielding connections between the gear and the shaft for timing the movements of the armature to the positions of the pistons in the cylinders, a cam for determining the variations of the yielding connections, and means co-operating with the cam and yielding connections for compelling the latter to be governed at all times by the cam.

964,301. ELECTRIC ILLUMINATED SIGN. William Nelson McComb, New York, N. Y. Filed Nov. 1908. Comprises a box, a faceplate for closing the box, a set of electric lamp sockets carried by the faceplate, the plate carrying outward extending marginal flanges or ribs surrounding the lamp sockets, a removable letter or character plate and means carried by the ribs for holding in place in front of the lamp sockets the removable letter or character plate.

964,336. MEANS FOR MAINTAINING VAPOR-CONVERTERS IN OPERATION. Percy H. Thomas, East Orange, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed Dec. 24, 1903. Divided and this application filed



964,336.—MEANS FOR MAINTAINING VAPOR-CONVERTERS IN OPERATION.

Oct. 19, 1904. A vapor converter has a plurality of main positive electrodes, and a common negative electrode, in combination with a source of normal electromotive-force and connections therefrom to the common negative electrode and the main positive electrodes, a source of accelerated electromotive-force, and connections therefrom to the common negative and the supplemental positive electrodes.

964,338. INSULATED RAIL-JOINT. William P. Thomson and Samuel G. Thomson, Philadelphia, Pa., assignors to Thomson-Thomson Company, Philadelphia, Pa. Filed Dec. 29, 1908. An inner bar contacts with one rail only and stands free from the rail foot and has at least two laterally extending faces above the rail base; an outer bar extends under these faces, and insulating material is interposed between the two bars.

964,343. ROTARY FIELD-MAGNET. Emil Volkers, Berlin, Germany. Filed April 2, 1909. A rotary field magnet comprises a shaft, the magnets being of such a spiral shape that their opposite poles are arranged with a certain interval of space between them, parallel to the shaft, while the center parts of the magnets are inclined in relation to the shaft, means for securing the magnets to the shaft, and a stationary armature around the magnets.

964,376. INSULATOR-SUPPORT. Jasper Blackburn, Kirkwood, Mo. Filed July 17, 1909. An insulator support comprises a pin, a base formed at a right angle to and integral with the pin, jaws arranged to embrace a cross arm and engage the base and means for securing the jaws to the cross arm.

964,379. VEHICLE-LIGHT. Wiley S. Bond, Lincoln, Kans. Filed July 2, 1909. An electric lamp is inserted in each pole tip.

964,418. ELECTROMAGNETIC CIRCUIT-CONTROLLER. Harry Grant Geissinger, New York, N. Y., assignor to Geissinger Regulator Company, New York, N. Y. Filed Dec. 23, 1909. An electromagnetic circuit-controlling device for connecting and disconnecting translating mechanism with main conductors, comprises an electromagnet having an armature and energizing coils for lifting and for retaining the armature respectively, means for connecting the lifting coil in series with the translating mechanism and the retaining coil directly between the main conductors, and means for short-circuiting the lifting coil.

964,442. TOBACCO-MOISTENER. Edward C. Madary, Traverse City, Mich. Filed Jan. 25, 1909. The humidor contains an electric lamp immersed in a liquid.

964,474. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. Dennis Joseph O'Brien, San Francisco, Cal., assignor to William P. Fairman, Philadelphia, Pa. Filed July 22, 1904. The process of manufacturing electric lamps comprises the formation of a perforated gland at a point intermediate the open ends of a hollow transparent tube, placing an anchor in the perforated gland through the adjacent open end of the tube, adjusting the filament and anchor through the adjacent open end of the tube, securing the anchor in position, exhausting the air in the tube, sealing the end of the hollow tube and securing the contact cap to the protruding end of the anchor.

REISSUE.

13,130. TELEGRAPHIC TRANSMITTER. Paul Dinger, Cleveland, Ohio, assignor of one-half to W. Louis Rose and one-half to Albert Lynn Lawrence, Cleveland, Ohio. Filed May 17, 1909. Original No. 920,034, dated April 27, 1909. The transmitter comprises a vibrator in the form of a spring bar fixed at one end, a coiled spring secured by one of its ends to the free end of the vibrator, a flexible cord secured to the other end of the spring, and means for taking in and paying out the cord.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 18, 1910.

501,485. INCANDESCENT-LAMP SOCKET. Henry P. Ball, Schenectady, N. Y.

501,488. REGULATING ELECTRIC LOCOMOTIVES. John B. Blood, Lynn, Mass.

501,491. INCANDESCENT ELECTRIC LAMP. Edward E. Cary, Boston, Mass.

501,502. INCANDESCENT-LAMP FIXTURE. Alenza T. Gifford, Hopedale, Mass.

501,529 and 501,530. INCANDESCENT ELECTRIC LAMP. William E. Nickerson, Cambridge, and Edward E. Cary, Boston, Mass.

501,531. INCANDESCENT ELECTRIC LAMP. William E. Nickerson, Cambridge, Mass.

501,532. DEVICE FOR REGULATING CONSTANT-CURRENT DYNAMO-ELECTRIC MACHINES. Olof Offrell, Middletown, Conn.

501,533. ELECTRICALLY-ILLUMINATED CHARACTER FOR ADVERTISING. Almon D. Page, Newark, N. J.

501,540, 501,541, 501,542 and 501,543. ELECTRIC MUSICAL INSTRUMENT. Paris E. Singer, London, Eng.

501,546. AUTOMATIC CHAIN-WELDING MACHINE. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass.

501,547. SHAPING AND SPINNING METALS BY ELECTRICITY. Elihu Thomson, Swampscott, Mass.

501,550. ELECTRIC BODY BATTERY. Harry C. Wagner, Cleveland, Ohio.

501,558. ELECTRO-MEDICAL APPARATUS. John A. Cabot, Cincinnati, O.

501,580. ELECTRIC-LAMP SOCKET. Gustave Sachs, St. Louis, Mo.

501,589. ELECTRICAL MEASURING INSTRUMENT. Rudolph M. Hunter, Philadelphia, Pa.

501,610. TRANSMITTER FOR TELEPHONES. James A. Brown, Moline, Ill.

501,631. ELECTRIC-CIRCUIT CONNECTION FOR SIGNALING OR TELEPHONE BOXES. John E. Smith, New York, N. Y.

501,676. ELECTRIC-RAILWAY CONDUIT. Irving J. Cook, Newark, N. J.

501,701. ELECTRIC-CONTROLLING AND LOCKING MECHANISM FOR RAILWAY SWITCHES AND SIGNALS. Charles M. Wilder, Cincinnati, O.

501,707. ELECTRIC SWITCH. William H. Dingle, and John M. Urquhart, London, Eng.

501,708. LIGHTNING-ARRESTER. Francis H. Doane, New York, N. Y.

501,755. METHOD FOR FORMING COAL-CUTTERS. Foree Bain, Chicago, Ill.

501,757. ELECTRIC-ARC LAMP. Sigmund Bergmann, New York, N. Y.

501,758. CARBON-HOLDER FOR ELECTRIC ARC LAMPS. Sigmund Bergmann, New York, N. Y.

501,768. ELECTRIC ARC LAMP. John T. Dempster, Summit, N. J.

501,825. METHOD OF AND APPARATUS FOR HEATING, WELDING, OR WORKING METALS ELECTRICALLY. Charles L. Coffin, Detroit, Mich.

501,842. ELECTRIC MOTOR. Malcolm W. Long, Harrisburg, Pa.

501,847. MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES. Charles E. Scribner, Chicago, Ill.

501,849. ELECTRIC BELT. Barney H. Standish, Evansville, Wis.

501,861. ELECTRIC BELT. Abraham D. Berliner, Rock Island, Ill.

501,884. ELECTRIC-ARC LAMP. William H. Klees, Susquehanna, Pa.

501,905. ELECTRIC FIRE-ALARM. Charles Bernhardt, Chicago, Ill.